

**STANDARDS PRESENTATION  
TO  
CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD**

Attachment No. 1

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TITLE 8, CHAPTER 4

Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 1. Definitions

§2300. Scope.

(a) Only definitions of terms peculiar to and essential to the proper use of this Safety Order are included. In general, only those terms used in two or more Articles are defined in Article 1. Other definitions are included in the Article in which they are used but may be referenced in Article 1.

(b) Definitions.

Acceptable. An installation or equipment is acceptable to the Division of Occupational Safety and Health, if approved as prescribed in Section 2305.4 of these Safety Orders.

Accepted. An installation is "accepted" if it has been inspected and found by a nationally recognized testing laboratory to conform to specified plans or to procedures of applicable codes.  
Accessible.

(A) Equipment Application (Other than Wiring Methods). Admitting close approach because not guarded by locked doors, elevation, or other effective means.

(B) Readily. Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc.

(C) Safely. Not exposing persons installing, operating, maintaining, or inspecting electrical apparatus to serious risks of tripping or falling or of coming in contact with energized electrical parts, moving machinery, surfaces or objects operating at high temperatures or other hazardous equipment.

(D) Wiring Method Application. Capable of being removed or exposed without damaging the building structure or finish, or not permanently closed in by the structure or finish of the building (see "Concealed" and "Exposed").

Ampacity. ~~Current-carrying capacity of electric conductors expressed in amperes.~~ The current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Appliance. Utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions such as clothes washing, air conditioning, food mixing, deep frying, etc.

Appliance, Fixed. An appliance which is fastened or otherwise secured at a specific location.

Appliance, Portable. An appliance which is actually moved or can easily be moved from one place to another in normal use.

Approved. The conductors and equipment required or permitted by these orders shall be acceptable to the Division of Occupational Safety and Health only if approved as prescribed in Section 2305.4 of these Safety Orders.

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Armored Cable (Type AC). A fabricated assembly of insulated conductors in a flexible metallic enclosure.

Askarel. A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. Askarels of various compositional types are used. Under arcing conditions the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases depending upon the askarel type.

Attachment Plug (Plug Cap) (Cap). A device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

Authorized Person. A qualified person delegated to perform specific duties under the conditions existing.

Automatic. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature, or mechanical configuration.

Bare Conductor. See Conductor.

Barrier. A physical obstruction that is intended to prevent contact with equipment or live parts or to prevent unauthorized access to a work area.

Bathroom. An area including a basin with one or more of the following: a toilet, a tub, or a shower.

Bond. An electrical connection from one metallic element to another for the purpose of minimizing potential differences and providing suitable conductivity for fault current or for mitigation of leakage current and electrolytic action.

Bonding (Bonded). The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

Bonding Jumper. A reliable conductor to assure the required electrical conductivity between metal parts required to be electrically connected.

Bonding Jumper, Circuit. The connection between portions of a conductor in a circuit to maintain required ampacity of the circuit.

Bonding Jumper, Equipment. The connection between two or more portions of the equipment grounding conductor.

Bonding Jumper, Main. The connection between the grounded circuit conductor and the equipment grounding conductor at the service.

Branch Circuit. The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Branch Circuit, Appliance. A branch circuit supplying energy to one or more outlets to which appliances are to be connected; such circuits to have no permanently connected lighting fixtures not a part of an appliance.

Branch Circuit, General Purpose. A branch circuit that supplies a number of outlets for lighting and appliances.

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Branch Circuit, Individual. A branch circuit that supplies only one utilization equipment.

Branch Circuit, Multiwire. A branch circuit consisting of two or more ungrounded conductors having a potential difference between them, and an identified grounded conductor having equal potential difference between it and each ungrounded conductor of the circuit and which is connected to the neutral conductor of the system.

Building. A structure which stands alone or which is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

Building Space. A room, vault, or wiring enclosures such as conduit, pull box, switchboards, and other like enclosures.

Cabinet. An enclosure designed either for surface or flush mounting and provided with a frame, mat, or trim in which a swinging door or doors are or can ~~may~~ be hung.

Cable Tray System. A unit or assembly of units or sections and associated fittings forming a rigid structural system used to securely fasten or support cables and raceways. Cable tray systems include ladders, troughs, channels, solid bottom trays, and other similar structures.

Cablebus. An assembly of insulated conductors with fittings and conductor terminations in a completely enclosed, ventilated, protective metal housing.

Cell Line. An assembly of electrically interconnected electrolytic cells supplied by a source of direct current power.

Cell Line Attachments and Auxiliary Equipment. Cell line attachments and auxiliary equipment include, but are not limited to, auxiliary tanks, process piping, ductwork, structural supports, exposed cell line conductors, conduits and other raceways, pumps, positioning equipment, and cell cutout or bypass electrical devices. Auxiliary equipment also includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone. In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.

Center Pivot Irrigation Machine. A multi-motored irrigation machine that revolves around a central pivot and employs alignment switches or similar devices to control individual motors.

Certified. Equipment is "certified" if it bears a label, tag, or other record of certification that the equipment:

(A) Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner; or

(B) Is of a kind whose production is periodically inspected by a nationally recognized testing laboratory and is accepted by the laboratory as safe for its intended use.

Circuit Breaker. A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage ~~injury~~ to itself when properly applied within its rating.

(A) Adjustable. (As applied to Circuit Breakers.) A qualifying term indicating that the circuit breaker can be set to trip at various values of current and/or time within a predetermined range.

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(B) Instantaneous Trip. (As applied to Circuit Breakers.) A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

(C) Inverse Time. (As applied to Circuit Breakers.) A qualifying term indicating there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

(D) Nonadjustable. (As applied to Circuit Breakers.) A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of current at which it will trip or the time required for its operation.

(E) Setting. (Of Circuit Breaker.) The value of current and/or time at which an adjustable circuit breaker is set to trip.

Concealed. Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. [See "Accessible--(As applied to wiring methods)"]

Conductor.

(A) Bare. A conductor having no covering or electrical insulation whatsoever. (See "Conductor, Covered.")

(B) Covered. A conductor encased within material of composition or thickness that is not recognized by these Orders as electrical insulation. (See "Conductor, Bare.")

(C) Insulated. A conductor encased within material of composition and thickness that is recognized by these Orders as electrical insulation.

Conduit. (See "Raceway.")

Conduit Body. A separate portion of a conduit or tubing system that provides access through one or more removable covers to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system. Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.

Connector, Pressure (Solderless). A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

Continuous Duty. (See under "Duty.")

Continuous Load. A load where the maximum current is expected to continue for three hours or more.

Controller. A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

Cooking Unit, Counter-Mounted. A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or separately mountable controls. (See "Oven, Wall-Mounted.")

Covered Conductor. (See under "Conductor.")

Cutout Box. An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box proper. (See "Cabinet.")

Damp Location. (See under "Location.")

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~~Dead Front (As applied to switches, circuit breakers, switchboards, control panels, and panelboards). So designed, constructed, and installed that no energized parts are exposed on the front. Without live parts exposed to a person on the operating side of the equipment.~~

Deenergized. Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

Demand Factor. The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

Device. A unit of an electrical system which is intended to carry but not utilize electric energy.

Dielectric Heating. The heating of a nominally insulating material due to its own dielectric losses when the material is placed in a varying electric field.

Different Systems. Those which derive their supply from different sources, or from individual transformers or banks of transformers which do not have their secondary windings interconnected, or from individual service switches.

Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Division. Unless otherwise designated in this subchapter, the term "Division" refers to the current Division of Occupational Safety and Health or any of its predecessors including the former Division of Industrial Safety or the Division of Occupational Safety and Health Administration. Reference to the former Division of Industrial Safety or Division of Occupational Safety and Health Administration in these orders is meant to refer to their successor, the Division of Occupational Safety and Health, or any subsequent successor agency.

Dry Location. (See under "Location.")

Dustproof. So constructed or protected that dust will not interfere with its successful operation.

Dust-Tight. So constructed that dust will not enter the enclosing case.

Duty.

(A) Continuous Duty. Operation at a substantially constant load for an indefinitely long time.

(B) Intermittent Duty. Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load and rest.

(C) Periodic Duty. Intermittent operation in which the load conditions are regularly recurrent.

(D) Short Time Duty. Operation at a substantially constant load for a short and definitely specified time.

(E) Varying Duty. Operation at loads, and for intervals of time, both of which may be subject to wide variation.

Electrolytic Cell Line Working Zone. The cell line working zone is the space envelope wherein operation or maintenance is normally performed on or in the vicinity of exposed energized surfaces of electrolytic cell lines or their attachments.

Electrolytic Cells. A tank or vat in which electrochemical reactions are caused by applying energy for the purpose of refining or producing usable materials.

Enclosed. Surrounded by a case, housing, fence or walls which will prevent persons from accidentally contacting energized parts.

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**Enclosure.** The case or housing of apparatus, or the fence or wall surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

**Energized.** Electrically connected to a source of potential difference.

**Energized Parts (Live Parts).** Parts which are of a potential different from that of the earth, or some conducting body which serves in place of the earth.

**Equipment.** A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.

**Equipment Grounding Conductor.** See "Grounding Conductor, Equipment."

**Explosion-Proof Apparatus.** Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and which operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

**Exposed.** (As applied to live parts.) Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated. (See "Accessible" and "Concealed.")

**Exposed.** (As applied to wiring methods.) On or attached to the surface or behind panels designed to allow access. [See "Accessible--(As applied to wiring methods.)"]

**Exposed.** (For the purposes of Article 87.) Where the circuit is in such a position that in case of failure of supports or insulation, contact with another circuit may result.

**Externally Operable.** Capable of being operated without exposing the operator to contact with live parts.

**Feeder.** All circuit conductors between the service equipment, the source of a separate derived system, or other power supply source ~~or the generator switchboard of an isolated plant~~, and the final branch circuit overcurrent device.

**Fitting.** An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

**Fountain.** Fountains, ornamental pools, display pools, and reflection pools.

**NOTE:** This definition does not include drinking fountains.

**Ground.** A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

**Grounded.** Connected to earth or to some conducting body that serves in place of the earth.

**Grounded, Effectively.** Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.

**Grounded Conductor.** A system or circuit conductor that is intentionally grounded.

**Grounding Conductor.** A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

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**Grounding Conductor, Equipment.** The conductor used to connect the noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor, ~~at the service and/or~~ the grounding electrode conductor, or both, at the service equipment or at the source of a separately derived system.

**Grounding Electrode Conductor, ~~Electrode~~.** The conductor used to connect the grounding electrode to the equipment grounding conductor, ~~and/or~~ to the grounded conductor, or to both, of the circuits at the service equipment or at the source of a separately derived system.

**Ground-Fault Circuit-Interrupter.** A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

**Guarded.** Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects ~~to a point of danger~~.

**Healthcare Facilities.** Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided.

**NOTE:** Healthcare facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

**Heating Equipment.** For the purposes of Article 77.2, the term “heating equipment” includes any equipment used for heating purposes if heat is generated by induction or dielectric methods.

**Hoistway.** Any shaftway, hatchway, well hole, or other vertical opening or space that is designed for the operation of an elevator or dumbwaiter.

**Identified (as applied to equipment).** Approved as suitable for the specific purpose, function, use, environment, or application, where described in a particular requirement.

**NOTE:** Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a nationally recognized testing laboratory (through listing and labeling), inspection agency, or other organization recognized under the definition of “acceptable.”

**Induction Heating.** The heating of a nominally conductive material due to its own  $I^2R$  losses when the material is placed in a varying electromagnetic field.

**Insulated.** Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

**Insulated Conductor.** See “Conductor, Insulated.”

**Interlock.** An electrical, mechanical, or key-locked device intended to prevent an undesired sequence of operations.

**Interrupting Rating.** The highest current at rated voltage that an overcurrent protective device is intended to interrupt under standard test conditions.

**Irrigation Machine.** An electrically driven or controlled machine, with one or more motors, not hand portable, and used primarily to transport and distribute water for agricultural purposes.

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Isolated. (As applied to location.) Not readily accessible to persons unless special means for access are used.

Isolated Power System. A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.

Labeled. Equipment is “labeled” if there is attached to it ~~or materials having~~ a label, symbol, or other identifying mark of a nationally recognized testing laboratory, ~~inspection agency, or other organization concerned with product evaluation~~ that maintains periodic inspection of production of such ~~labeled~~ equipment ~~or materials~~ and by whose labeling is indicated compliance with nationally recognized standards or tests to determine ~~safe~~ suitable usage in a specified manner.

Lighting Outlet. An outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

Listed. Equipment or materials included in a list published by a nationally recognized testing laboratory, ~~inspection agency, or other organization concerned with product evaluation~~ that maintains periodic inspection of production of such ~~listed~~ equipment ~~or materials~~, and whose listing states either that the equipment ~~or material~~ meets nationally recognized standards or has been tested and found ~~safe~~ suitable for use in a specified manner.

~~The means for identifying listed equipment may vary for each testing laboratory, inspection agency, or other organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.~~

Live Parts. Energized conductive components.

Location.

(A) Damp Location. Partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.

(B) Dry Location. A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

(C) Wet Location. Installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as vehicle washing areas, and locations exposed to weather and unprotected.

Locking in the Open Position. The use of lockable devices, such as padlocks, combination locks or other positive methods or procedures which will effectively prevent unexpected or inadvertent energizing of a designated circuit, equipment or appliance.

Metal-Clad Cable (Type MC). A factory assembly of one or more insulated circuit conductors with or without optical fiber members enclosed in an armor of interlocking metal tape, or a smooth or corrugated metallic sheath.

Metal-Enclosed. Metal-enclosed, as an adjective, refers to electrical apparatus surrounded by a metal case or housing.



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Mineral-Insulated Metal-Sheathed Cable (Type MI). Type MI, mineral-insulated metal-sheathed, cable is a factory assembly of one or more conductors insulated with a highly compressed refractory mineral insulation and enclosed in a liquidtight and gastight continuous copper or alloy steel sheath.

Mobile X-Ray. X-ray equipment mounted on a permanent base with wheels or casters or both for moving while completely assembled.

Motor Control Center. An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

Nonmetallic-Sheathed Cable (Types NM, NMC, and NMS). A factory assembly of two or more insulated conductors having an outer sheath of moisture resistant, flame-retardant, nonmetallic material.

Open Wiring. Uninsulated conductors or insulated conductors without grounded metallic sheaths or shields installed above ground, but not inside apparatus or wiring enclosures.

Open Wiring on Insulators. Open wiring on insulators is an exposed wiring method using cleats, knobs, tubes, and flexible tubing for the protection and support of single insulated conductors run in or on buildings, and not concealed by the building structure.

Outlet. A point on the wiring system at which current is taken to supply utilization equipment.

Outline Lighting. An arrangement of incandescent lamps or electric discharge ~~tubing~~ lighting to outline or call attention to certain features such as the shape of a building or the decoration of a window.

Oven, Wall-Mounted. An oven for cooking purposes designed for mounting in or on a wall or other surface and consisting of one or more heating elements, internal wiring, and built-in or separately mountable controls. (See "Cooking Unit, Counter-Mounted.")

Overcurrent. Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.

Overload. Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (See Overcurrent.)

Panelboard. A single panel or group of panel units designed for assembly in the form of a single panel including buses, automatic overcurrent devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See "Switchboard.")

Permanently Installed Decorative Fountains and Reflection Pools. Pools that are constructed in the ground, on the ground, or in a building in such a manner that the fountain or pool cannot be readily disassembled for storage, whether or not served by electrical circuits of any nature. These units are primarily constructed for their aesthetic value and are not intended for swimming or wading.

Permanently Installed Swimming, Wading, and Therapeutic Pools. Pools that are constructed in the ground or partially in the ground, and all other capable of holding water in a depth greater

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than 42 in. (1.07 m). The definition also applies to all pools installed inside of a building, regardless of water depth, whether or not served by electric circuits of any nature.

Portable X-Ray. X-ray equipment designed to be hand-carried.

Power and Control Tray Cable (Type TC). A factory assembly of two or more insulated conductors, with or without associated bare or covered grounding conductors under a nonmetallic sheath, approved for installation in cable trays, in raceways, or where supported by a messenger wire.

Power-Limited Tray Cable (Type PLTC). A factory assembly of two or more insulated conductors under a nonmetallic jacket.

Power Outlet. An enclosed assembly which may include receptacles, circuit breakers, fuseholders, fused switches, buses and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles or boats, or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Premises Wiring (Premises Wiring System). That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices; both permanently and temporarily installed which extends from the service point of utility conductors or source of power (such as a battery, a solar photovoltaic system, or a generator, transformer, or converter) load end of the service drop, or load end of the service lateral conductors to the outlet(s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment.

Pull Box. A box with a blank cover into which workers may reach but not enter which is inserted in one or more runs of raceway to facilitate pulling, joining, supporting, distributing or inspecting conductors. The term "pull box" includes but is not limited to: junction boxes, splice boxes, conductor support boxes, inspection boxes, and handholes.

Qualified Person. A person, designated by the employer, who ~~by reason of experience or instruction has demonstrated familiarity with the operation to be performed and the hazards involved.~~ has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved.

NOTES:

1. Whether an employee is considered to be a "qualified person" will depend upon various circumstances in the workplace. For example, it is possible for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment.

2. An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

Raceway. An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in these orders.

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Raceways include, but are not limited to ~~may be of metal or insulating material, and the term includes~~ rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid-tight flexible ~~metal~~ conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

Rainproof. So constructed, protected, or treated as to prevent rain from interfering with successful operation of the apparatus.

Raintight. So constructed or protected that exposure to a beating rain will not result in the entrance of water.

Receptacle. A contact device installed at the outlet for the connection of an ~~single~~ attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is ~~a single device containing~~ two or more contact devices on the same yoke ~~receptacles~~.

Receptacle Outlet. An outlet where one or more receptacles are installed.

Remote-Control Circuit. Any electric circuit that controls any other circuit through a relay or an equivalent device.

Separately Derived System. A premises wiring system whose power is derived from a battery, a solar photovoltaic system, or from a generator, transformer, or converter windings and that has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

Service. The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.

Service Cable. Service conductors made up in the form of a cable.

Service Conductors. The supply conductors that extend from the street main or from transformers to the service equipment of the premises supplied. The conductors from the service point to the service disconnecting means.

Service Drop. The overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service-entrance conductors at the building or other structure.

Service-Entrance Cable. A single conductor or multiconductor assembly provided with or without an overall covering, primarily used for services, and is of the following types:

(A) Type SE. Type SE, having a flame-retardant, moisture resistant covering; and

(B) Type USE. Type USE, identified for underground use, having a moisture-resistant covering, but not required to have a flame-retardant covering. Cabled, single-conductor, Type USE constructions recognized for underground use may have a bare copper conductor cabled with the assembly. Type USE single, parallel, or cable conductor assemblies recognized for underground use may have a bare copper concentric conductor applied. These constructions do not require an outer overall covering.

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Service-Entrance Conductors, Overhead System. The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop.

Service-Entrance Conductors, Underground System. ~~That portion of the service conductors between the terminal box located either inside or outside the building wall, or the point of entrance in the building if no terminal box is installed, and the service equipment.~~ The service conductors between the terminals of the service equipment and the point of connection to the service lateral.

Service Equipment. The necessary equipment, usually consisting of one or more a-circuit breakers or switches and fuses, and their accessories, connected to the load end of service conductors located near the point of entrance of supply conductors to a building or other structure, or an otherwise designated defined area, and intended to constitute the main control and ~~means of~~ cutoff of the supply.

Service Point. The point of connection between the facilities of the serving utility and the premises wiring.

Service Lateral. The underground service conductors between the street main, including any risers at a pole or other structure or from transformers, and the first point of connection to the service-entrance conductors in a terminal box or meter or other enclosure with adequate space inside or outside the building wall. Where there is no terminal box, meter, or other enclosure with adequate space, the point of connection shall be considered to be the point of entrance of the service conductors into the building.

Service Raceway. The raceway that encloses the service-entrance conductors.

Shielded Nonmetallic-Sheathed Cable (Type SNM). A factory assembly of two or more insulated conductors in an extruded core of moisture-resistant, flame-resistant nonmetallic material, covered with an overlapping spiral metal tape and wire shield and jacketed with an extruded moisture-, flame-, oil-, corrosion-, fungus-, and sunlight-resistant nonmetallic material.

Show Window. Any window used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level.

Signaling Circuit. Any electric circuit that energizes signaling equipment.

Storable Swimming or Wading Pool. A pool that is constructed on or above the ground and is capable of holding water to a maximum depth of 42 in. (1.07 m), or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

Suitable. Capable of performing with safety the particular function specified in these Orders.  
Switches.

(A) General-Use Switch. A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage.

(B) General-Use Snap Switch. A form of general-use switch so constructed that it can be installed in ~~flush~~ device boxes or on ~~outlet~~ box covers, or otherwise used in conjunction with wiring systems recognized by this Order.

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(C) Isolating Switch. A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

(D) Motor Circuit Switch. A switch, rated in horsepower, capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

Switchboard. A large single panel, frame, or assembly of panels on which are mounted, on the face or back or both, switches, overcurrent and other protective devices, buses, and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See "Panelboard.")

Thermal Cutout. An overcurrent protective device that contains a heater element in addition to and affecting a renewable fusible member which opens the circuit. It is not designed to interrupt short-circuit currents.

Thermally Protected. (As applied to motors.) The words "Thermally Protected" appearing on the nameplate of a motor or motor-compressor indicate that the motor is provided with a thermal protector.

Thermal Protector. An inherent overheating protective device which is responsive to temperature and/or current and which protects the equipment against overheating due to overload or failure to start.

Utilization Equipment. Equipment which utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

Vehicle. A device by which any person or property may be propelled, moved, or drawn, excepting a device moved by human power or used exclusively upon stationary rails or tracks.

Ventilated. Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

Volatile Flammable Liquid. A flammable liquid having a flash point below 38°C (100°F) or a flammable liquid whose temperature is above its flash point, or a Class II combustible liquid having a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F) and whose temperature is above its flash point.

Voltage (of a Circuit). The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.

Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct-current may have various circuits of various voltages.

Voltage, Nominal. A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240 volts, 480Y/277 volts, 600 volts, etc.).

The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment. (See "Voltage Ratings for Electric Power Systems and Equipment (60 Hz)," ANSI C84.1-1977 and supplement C84.1a-1980.)

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Voltage to Ground. For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

Watertight. So constructed that moisture will not enter the enclosure.

Weatherproof. So constructed or protected that exposure to the weather will not interfere with successful operation.

Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof, where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

~~(Title 24, Part 3, Article 3-100.)~~

Wireways. Sheet-metal troughs with hinged or removable covers for housing and protecting electric wires and cable and in which conductors are laid in place after the wireway has been installed as a complete system.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 1893(c), Health and Safety Code.~~

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 2. Administration

§2305.2. Application.

(a) These Low-Voltage Electrical Safety Orders apply to all electrical installations and electrical equipment operating or intended to operate on systems of 600 volts, nominal, or less and to all work performed directly on or in proximity to such electrical installations, equipment or systems in all places of employment in the State of California as defined in Labor Code Section 6303.

(1) These Orders do not apply to:

(A) ~~(1)~~ Installations or conductors and equipment in ships, watercraft, railway rolling stock, or aircraft, or automotive vehicles other than mobile homes and recreational vehicles.

(B) ~~(2)~~ Installations of conductors and equipment in vehicles, operating at less than 50 volts or to their ignition system, unless otherwise specified.

(C) ~~(3)~~ Installations of conductors, equipment, and associated enclosures subject to the jurisdiction of the California Public Utilities Commission, that are owned, operated and maintained by an electric, communication or electric railway utility.

EXCEPTION NO. 1. These orders apply to conduit, vaults, and other like enclosures containing the conductors and equipment of such a utility when located indoors on premises not used exclusively for utility purposes, but do not apply to the utilities conductors and the equipment therein.

EXCEPTION NO. 2. Article 3, Work Procedures, apply to all work performed by electric utilities.

~~(Title 24, Part 3, Section 3-089 4.)~~

(b) Extent of application. ~~After the date on which these Orders become effective, all installations and equipment shall conform to these Orders.~~

~~EXCEPTION: Existing installations and equipment which were in compliance with safety orders, or variances therefrom, in effect prior to the effective date of these Safety Orders, unless the hazard presented by the installation or equipment is, in the judgement of the Chief of the Division, of such severity as to warrant control by the application of the applicable Sections of these Orders.~~

(1) Requirements applicable to all installations.

The following requirements apply to all electrical installations and utilization equipment, regardless of when they were designed or installed:

Sec. 2340.2 – Examination, Installation, and Use of Equipment.

Sec. 2340.8 – Insulation Integrity.

Sec. 2340.9 – Interrupting Rating.

Sec. 2340.10 – Circuit Impedance and Other Characteristics.

Sec. 2340.11 – Deteriorating Agents.

Sec. 2340.12 – Mechanical Execution of Work.

Sec. 2340.13 – Mounting and Cooling of Equipment.

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Sec. 2340.14(c) – Electrical Connections – Splices.  
Sec. 2340.17 – Guarding of Energized Parts.  
Sec. 2340.18 – Arcing Parts.  
Sec. 2340.21 – Marking.  
Sec. 2340.22(a)-(d) – Identification of Equipment.  
Sec. 2350.2 – Use and Identification of Grounded and Grounding Conductors – General.  
Sec. 2390.1 – Overcurrent Protection – General.  
Sec. 2390.24 – Location.  
Sec. 2390.41 – Arcing or Suddenly Moving Parts.  
Sec. 2395.3(a) – Grounding – Direct Current Systems.  
Sec. 2395.5 – Grounding – Alternating-Current – Circuits and Systems to Be Grounded.  
Sec. 2395.23 – Grounding Connections.  
Sec. 2395.42(a)-(d) – Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed).  
Sec. 2395.44 – Nonelectrical Equipment.  
Sec. 2395.45 – Equipment Connected by Cord and Plug (without exceptions).  
Sec. 2395.51 – Effective Grounding.  
Sec. 2395.57 – Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed)--Grounding.  
Sec. 2500.7 - Flexible Cords and Cables – Uses Permitted.  
Sec. 2500.8 - Flexible Cords and Cables – Uses Not Permitted.  
Sec. 2500.9 - Splices.  
Sec. 2500.10 - Pull at Joints and Terminals.  
Sec. 2500.11 - In Show Windows and Show Cases.  
Article 59. Hazardous (Classified) Locations – except as specified in Section 2540.2(a) Documentation.  
(2) Requirements applicable to installations made after March 15, 1972.  
Every electrical installation and all utilization equipment installed or overhauled after March 15, 1972, shall comply with the provisions of these Safety Orders, except as noted in Sections 2305.2(b)(3) and (b)(4) of this Article.  
(3) Requirements applicable only to installations made after April 16, 1981. The following requirements apply only to electrical installations and utilization equipment installed after April 16, 1981:  
Sec. 2390.81(b) – Circuit Breakers.  
Sec. 2390.81(c) – Circuit Breakers.  
Sec. 2562.6 – Elevators, Dumbwaiters, Escalators, Moving Walks, Wheelchair Lifts, and Stairway Chair Lifts – Interconnection Between Multicar Controllers.  
Article 78 – Electrically Driven or Controlled Irrigation Machines  
Sec. 2569.51 – Fountains.



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Sec. 2585.2 – Class 1, Class 2, and Class 3 remote control, signaling, and power-limited circuits—Marking.

Article 86 – Fire Alarm Systems

(4) Requirements applicable only to installations made after [effective date of these Orders].

The following requirements apply only to electrical installations and utilization equipment installed after [effective date of these Orders]:

Sec. 2340.16(d)(1) – Work Space About Electric Equipment.

Sec. 2340.16(g) – Work Space About Electric Equipment.

Sec. 2340.22(e) – Identification of Equipment – Capable of Accepting a Lock.

Sec. 2340.22(f) – Identification of Equipment – Marking for Series Combination Ratings.

Sec. 2360.1 – Identification of Multiwire Branch Circuits.

Sec. 2360.3 – Ground-Fault Circuit Interrupter Protection for Personnel-General Industry.

Sec. 2480.7(b) – Connection of Switches.

Sec. 2480.9(b) – Snap Switches.

Sec. 2560.2(c) – Electric Signs and Outline Lighting--Disconnecting Means.

Sec. 2562.2(c) – Elevators, Dumbwaiters, Escalators, Moving Walks, Wheelchair Lifts, and Stairway Chair Lifts –Disconnecting Means – Operation.

Sec. 2562.2(d) – Elevators, Dumbwaiters, Escalators, Moving Walks, Wheelchair Lifts, and Stairway Chair Lifts – Disconnecting Means - Location.

Sec. 2562.3 – Identification and Signs.

Sec. 2562.4 – Single-Car and Multi-Car Installations.

2569.5(c) – Swimming Pools, Fountains, and Similar Installations – Receptacles.

Sec. 2571.30 - Emergency Power Systems – Signs.

Article 84. Carnivals, Circuses, Fairs, and Similar Events

Sec. 2585.3 – Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits – Separation From Conductors of Other Circuits.

Article 88. Solar Photovoltaic Systems

(c) Regulations herein which may affect Building Standards apply to all building, or building alteration, or building modification for which construction is commenced after the effective date of the regulations. Date of commencement of construction for the purpose of this Section, shall be:

(1) The advertising date for invitation of bids for State and local government projects;

(2) The building construction permit issuance date for other than government projects.

~~(Title 24, Part 3, Section 3-089-14.)~~

(d) For installation requirements not specifically contained herein, installations in compliance with CCR, Title 24, Part 3, ~~State~~ California Electrical Code, in effect at the time of construction, will be considered as complying with the intent of these orders.

(e) Nothing contained in these regulations shall be considered as abrogating the provisions relating to public safety of any ordinance, rule or regulation of any governmental agency,

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providing such local ordinance, rule or regulation does not lessen the provisions for safety contained in these regulations.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

\*\*\*\*\*

§2305.4. Approvals.

The conductors and equipment required or permitted by these orders shall be acceptable only if approved.

~~(Title 24, Part 3, Section 110-2.)~~

(a) When the term "approved" is used in these orders, it shall refer to products, materials, devices, systems, or installations that have been approved, listed, labeled, or certified as conforming to applicable governmental or other nationally recognized standards, or applicable scientific principles. The approval, listing, labeling, or certification of conformity, shall be based upon an evaluation performed by a nationally recognized testing laboratory recognized pursuant to 29 CFR §1910.7, which is incorporated by reference; or by a person, firm, or entity with appropriate registered engineering competence or by a person, firm, or entity, independent of the manufacturer or supplier of the product, with demonstrated competence in the field of such evaluation.

EXCEPTION: Where written approval by the Division is required in these orders.

(b) The Division may require proof in addition to that under (a) that the products, materials, devices, systems, or installations will provide reasonable safety under the conditions of use.

(c) When these orders require an approval of products, materials, devices, systems, or installations and that approval is not available under (a), it will be necessary to submit to the Division engineering calculations, stress analyses, and other data for each design, model, or make for which an approval is requested. The Division will then approve or disapprove the product, material, device, system, or installation as submitted or under specified conditions.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 4. Requirements for Electrical Installations

§2340.2. Examination, Installation, and Use of Equipment.

(a) Examination. Electric equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment shall be determined using the following considerations:

(1) Suitability for installation and use in conformity with the provisions of these Orders;

NOTE to subsection (a)(1): Suitability of equipment for an identified purpose may be evidenced by listing or labeling for that identified purpose.

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided;

(3) Wire-bending and connection space;

(4) Electrical insulation;

(5) Heating effects under all conditions of use;

(6) Arcing effects;

(7) Classification by type, size, voltage, current capacity, and specific use; and

(8) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment.

(b) Installation and use. Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2340.5. Conductors. ~~(Repealed)~~

(a) Insulation. All conductors used for general wiring shall be insulated unless otherwise permitted in these safety orders.

(b) Type. The conductor insulation shall be of a type that is approved for the voltage, operating temperature, and location of use.

(c) Distinguishable. Insulated conductors shall be distinguishable by appropriate color or other suitable means as being grounded conductors, ungrounded conductors, or equipment grounding conductors.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2340.8. ~~Wiring Methods. (Repealed)~~ Insulation Integrity.

Completed wiring installations shall be free from short circuits and from grounds other than those required or permitted by these Safety Orders.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2340.9. Interrupting Rating.

(a) Equipment intended to ~~interrupt break~~ current at fault levels shall have an interrupting rating sufficient for the nominal circuit system voltage and the current which is available at the line terminals of the equipment.

(b) Equipment intended to ~~interrupt break~~ current at other than fault levels shall have an interrupting rating at nominal circuit system voltage sufficient for the current that must be interrupted.

~~(Title 24, Part 3, Section 110-9.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2340.10. Circuit Impedance and Other Characteristics. ~~(Repealed)~~

The overcurrent protective devices, the total impedance, the component short-circuit current ratings, and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault to do so without the occurrence of extensive damage to the electrical components of the circuit. This fault shall be assumed to be either between two or more of the circuit conductors, or between any circuit conductor and the grounding conductor or enclosing metal raceway.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2340.11. Deteriorating Agents.

(a) Unless approved for the purpose, no conductors or equipment shall be located:

(1) ~~Located in~~ damp or wet locations.

(2) ~~Where Exposed~~ to gases, fumes, vapors, liquids, or other agents that which could have a deteriorating effect on the conductors or equipment.

(3) ~~Where Exposed~~ to excessive temperatures.

~~(Title 24, Part 3, Section 110-11.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2340.12. ~~Installation and Maintenance. (Repealed)~~ Mechanical Execution of Work.

Electric equipment shall be installed in a neat and workmanlike manner.

(a) Unused openings in boxes, raceways, auxiliary gutters, cabinets, equipment cases, or housings shall be effectively closed to afford protection substantially equivalent to the wall of the equipment.

(b) Conductors shall be racked to provide ready and safe access in underground and subsurface enclosures that persons enter for installation and maintenance.

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(c) Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues.

(d) There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment, such as parts that are broken, bent, cut, or deteriorated by corrosion, chemical action, or overheating.

NOTE: Authority cited: Section 142.3, Labor Code. Reference Section 142.3, Labor Code.

§2340.13. Mounting and Cooling of Equipment.

(a) Mounting. Electric equipment shall be firmly secured to the surface on which it is mounted.

NOTE: Wooden plugs driven into holes in masonry, concrete, plaster, or similar materials are not considered secure means of fastening electric equipment

(b) Electric equipment that depends on the natural circulation of air and convection principles for cooling of exposed surfaces shall be installed so that room airflow over such surfaces is not prevented by walls or by adjacent installed equipment. For equipment designed for floor mounting, clearance between top surfaces and adjacent surfaces shall be provided to dissipate rising warm air.

(c) ~~(b)~~ Cooling. Electrical equipment provided with ventilating openings shall be installed and maintained so that free circulation of air through the equipment is not obstructed.

(Title 24, Part 3, Section 110-13.)

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2340.14. Electrical Connections. ~~(Repealed)~~

(a) General. Because of different characteristics of dissimilar metals:

(1) Devices such as pressure terminal or pressure splicing connectors and soldering lugs shall be identified for the material of the conductor and shall be properly installed and used;

(2) Conductors of dissimilar metals may not be intermixed in a terminal or splicing connector where physical contact occurs between dissimilar conductors (such as copper and aluminum, copper and copper-clad aluminum, or aluminum and copper-clad aluminum) unless the device is identified for the purpose and conditions of use; and

(3) Materials such as solder, fluxes, inhibitors, and compounds, where employed, shall be suitable for the use and shall be of a type that will not adversely affect the conductors, installation, or equipment.

(b) Terminals.

(1) Connection of conductors to terminal parts shall ensure a good connection without damaging the conductors and shall be made by means of pressure connectors (including set-screw type),

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solder lugs, or splices to flexible leads. However, No. 10 or smaller conductors may be connected by means of wire binding screws or studs and nuts having upturned lugs or equivalent.

(2) Terminals for more than one conductor and terminals used to connect aluminum shall be so identified.

(c) Splices.

(1) Conductors shall be spliced or joined with splicing devices identified for the use or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be spliced or joined to be mechanically and electrically secure without solder and then soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an insulating device identified for the purpose.

(2) Wire connectors or splicing means installed on conductors for direct burial shall be listed for such use.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2340.16. Work Space About Electric Equipment.

(a) Space about electric equipment.

Sufficient ~~Suitable~~ access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

(b) Work Space. Working space for equipment likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the following dimensions, except as required or permitted elsewhere in these Orders.

(1) Depth. ~~Except as elsewhere required or permitted in these orders, the~~ The depth dimension of the working space in the direction of access to energized live parts in switchboards, control panels, fused switches, circuit breakers, panelboards, motor controllers, and similar equipment which require examination, adjustment, servicing, or maintenance while energized, shall not be less than indicated in Table 2340.16 unless permitted elsewhere in these orders.

Distances shall be measured from the live parts if they are exposed or from the enclosure front or opening if they are enclosed.

(2) Width. In addition to the dimensions of depth shown in Table 2340.16, the width of the workspace in front of the electric ~~the direction of access to the~~ equipment shall not be less than the width of the equipment or 30 inches, whichever is greater wide. ~~Depth distances shall be measured from the energized parts if such are normally exposed or from the enclosure front or opening if such are normally enclosed.~~

(A) Concrete, brick, or tile walls shall be considered as grounded.

(B) In all cases, the workspace shall be adequate to permit at least a 90 degree opening of equipment doors or hinged panels.

EXCEPTION: Working space shall not be required in back of assemblies, such as dead front switchboards or motor controllers where there are no renewable or adjustable parts such as fuses

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~~or switches on the back and where all connections are accessible from locations other than the back.~~

(3) Height. The work space shall be clear and extend from the grade, floor, or platform to the height required by subsection (f) of this section. However, other equipment associated with the electrical installation and located above or below the electric equipment may extend not more than 6 in. (153 mm) beyond the front of the electric equipment.

Table 2340.16. Minimum Depth of Clear Working Space at Electric Equipment, 600 V or Less

<u>Nominal Voltage to Ground</u>	<u>Minimum Clear Distance (Feet)</u>					
	<u>Condition 1</u>		<u>Condition 2</u>		<u>Condition 3</u>	
	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>
0-150	3*	0.9	3*	0.9	3	0.9
151-600	3*	0.9	3.5	1.0	4	1.2

~~\*EXCEPTION: Minimum clear distances may be 2 feet 6 inches for installations built prior to April 16, 1981.~~

Notes to Table 2340.16:

Where the "Conditions" are as follows:

Condition (1)--Exposed ~~energized live~~ parts on one side and no ~~energized live~~ or grounded parts on the other side of the working space, or exposed ~~energized live~~ parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at 300 volts or less shall not be considered ~~energized live~~ parts.

Condition (2)--Exposed ~~energized live~~ parts on one side and grounded parts on the other side.

Condition (3)--Exposed ~~energized live~~ parts on both sides of the work space (not guarded as provided in Condition (1)) with the operator between.

~~(See also Plates 2340.16(a)(1) and 2340.16(a)(2).)~~

EXCEPTIONS:

\*1. Minimum clear distances may be 2.5 ft. (0.7 m) for installations built before April 16, 1981.

2. Working space is not required in back of assemblies such as dead-front switchboards or motor control centers where there are no renewable or adjustable parts (such as fuses or switches) on the back and where all connections are accessible from locations other than the back.

3. Where rear access is required to work on deenergized parts on the back of enclosed equipment, a minimum working space of 30 in. (762 mm) horizontally shall be provided.

(c) Clear Spaces. Working space required by this section shall not be used for storage. When normally enclosed ~~live energized~~ parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.

(d) Entrance and Access to Workspace. At least one entrance of sufficient area shall be provided to give access to the working space about electric equipment.

(1) For ~~equipment switchboards and control panels~~ rated 1,200 amperes or more and over 6 feet (1.83 m) wide, ~~containing overcurrent devices, switching devices, or control devices,~~ there shall

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be one entrance not less than 24 inches (610 mm) wide and 6 feet 6 inches (1.98 m) high at each end of the workspace, except that:

(A) Where the location permits a continuous and unobstructed way of exit travel, one means of exit is permitted; or

(B) Where the working space required by subsection (b) of this section is doubled, only one entrance to the working space is required; however, the entrance shall be located so that the edge of the entrance nearest the equipment is the minimum clear distance given in Table 2340.16 away from such equipment.

(2) Attics, furred ceilings and underfloor spaces shall have minimum unobstructed access openings of 22 inches by 30 inches.

(e) Illumination. Portable or fixed illumination, suitable for the nature of the work being performed, shall be provided when working on electrical equipment. The light fixtures and their control points shall be so arranged that persons operating light switches, replacing lamps or making repairs on the lighting system will not be endangered by energized parts of other equipment.

EXCEPTION: Additional lighting fixtures are not required where the working space is illuminated by an adjacent light source. In electric equipment rooms, the illumination may not be controlled by automatic means only.

(f) Headroom. The minimum headroom of working space about service equipment, switchboards, panelboards and motor ~~controllers~~ control centers, which require manual operation or where there are energized parts exposed at any time, shall be as follows:

(1) For installations built before [effective date of these orders] 6 feet 3 inches (1.91 m).

(2) For installations built on or after [effective date of these orders] 6 feet 6 inches (1.98 m), except that where the electrical equipment exceeds 6.5 feet (1.98 m) in height, the minimum headroom may not be less than the height of the equipment.

(g) For installations built on or after [effective date of these orders], switchboards, panelboards, and distribution boards installed for the control of light and power circuits, and motor control centers shall be located in dedicated spaces and protected from damage.

(1) Indoor. For indoor installation, the dedicated space shall comply with the following:

(A) The space equal to the width and depth of the equipment and extending from the floor to a height of 6.0 feet (1.83 m) above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. Unless isolated from equipment by height or physical enclosures or covers that will afford adequate mechanical protection from vehicular traffic or accidental contact by unauthorized personnel or that complies with subsection (g)(1)(B) of this section, piping, ducts, or equipment foreign to the electrical installation shall not be located in this area;

(B) The space equal to the width and depth of the equipment shall be kept clear of foreign systems unless protection is provided to avoid damage from condensation, leaks, or breaks in such foreign systems. This area shall extend from the top of the electric equipment to the structural ceiling;



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(C) Sprinkler protection is permitted for the dedicated space where the piping complies with this section; and

(D) Control equipment that by its very nature or because of other requirements in these Orders must be adjacent to or within sight of its operating machinery is permitted in the dedicated space.

NOTE to subsection (g)(1): A dropped, suspended, or similar ceiling that does not add strength to the building structure shall not be considered a structural ceiling.

(2) Outdoor. Outdoor electric equipment shall be installed in suitable enclosures and shall be protected from accidental contact by unauthorized personnel, or by vehicular traffic, or by accidental spillage or leakage from piping systems. No architectural appurtenance or other equipment may be located in the working space required by subsection (b) of this section.

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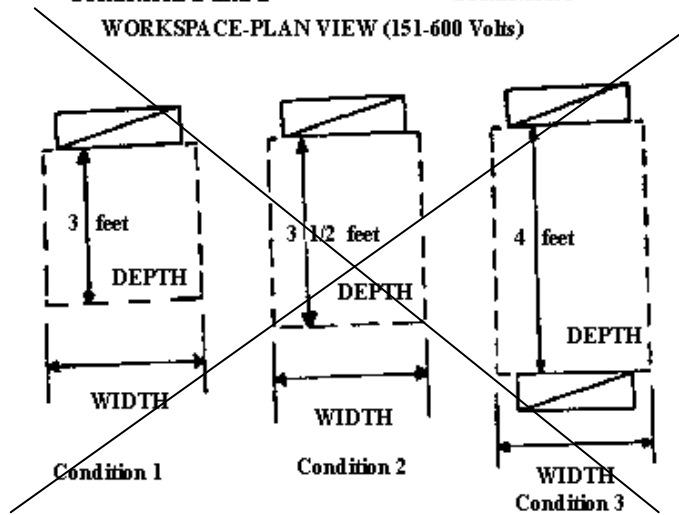
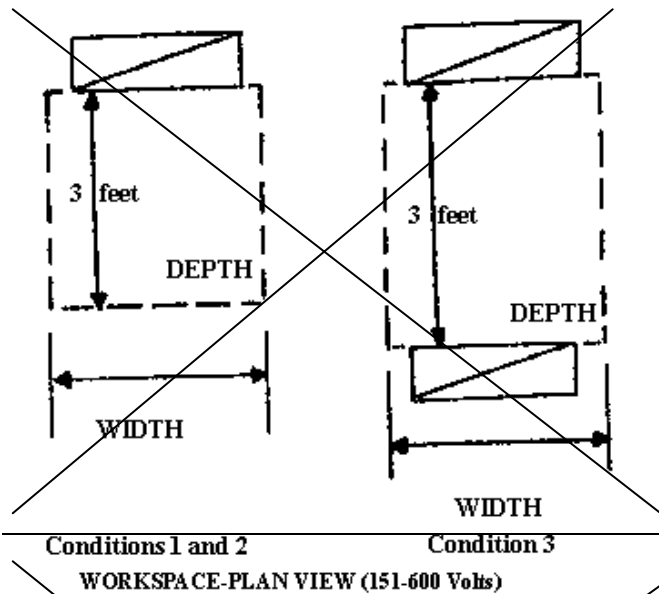
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~~WORKSPACE REQUIREMENTS (See Section 2340.16)~~

~~Plate 2340.16(a)(1) [Deleted]~~

~~WORKSPACE-PLAN VIEW (0-150 Volts) & PLAN VIEW (151-600 Volts) [Repealed]~~



~~Workspace WIDTH: 30 inches wide, or the width of the equipment, whichever is greater.~~

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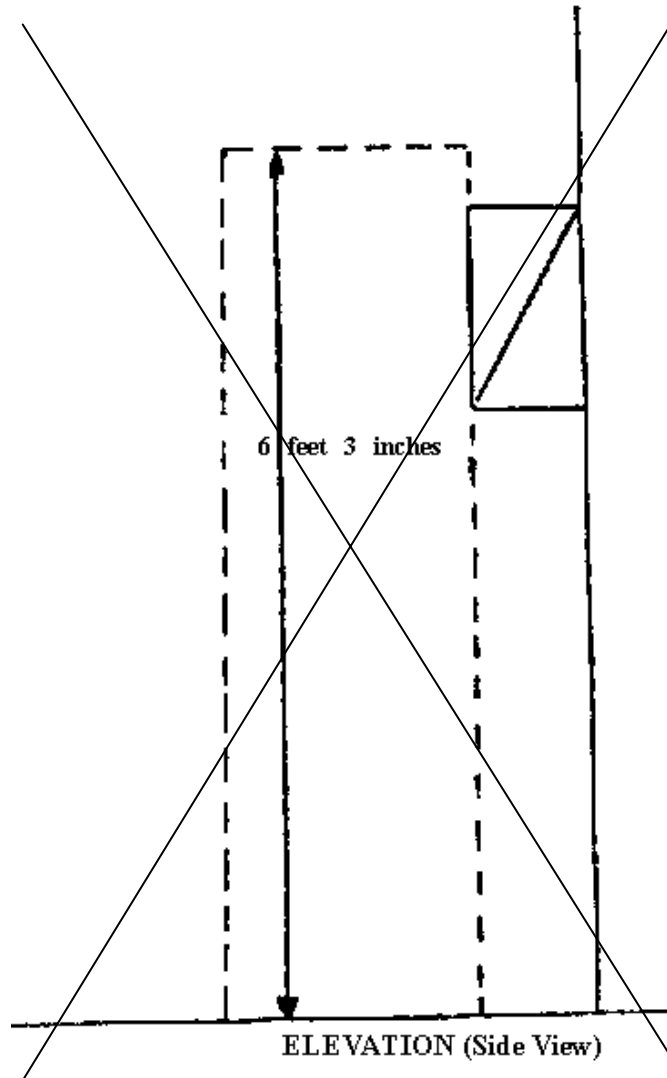
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~~WORKSPACE REQUIREMENTS (See Section 2340.16) [Repealed]~~

~~Plate 2340.16(a)(2) [Deleted]~~

~~WORKSPACE HEIGHT~~



~~(Title 24, Part 3, Section 110-16.)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and  
Section 18943(c), Health and Safety Code.-~~

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§2340.17. Guarding of Energized Parts.

(a) Except as elsewhere required or permitted by these orders, energized parts of electric equipment operating at 50 volts or more shall be guarded against accidental contact by use of approved cabinets or other forms of approved enclosures or by any of the following means:

(1) By location in a room, vault, or similar enclosure that is accessible only to qualified persons.

(2) By suitable permanent, substantial partitions or screens so arranged that only qualified persons will have access to the space within reach of the energized parts. Any openings in such partitions or screens shall be so sized and located that persons are not likely to come into accidental contact with the energized parts or to bring conducting objects into contact with them.

(3) By location on a suitable balcony, gallery, or platform so elevated and arranged as to exclude unqualified persons otherwise located as to prevent access by unqualified persons; or

~~(Title 24, Part 3, Section 110-17(a).)~~

(4) By elevation of 8.0 feet (2.44 m) or more above the floor or other working surface.

(b) In locations where electric equipment is likely to be exposed to physical damage, enclosures or guards shall be so arranged and of such strength as to prevent such damage.

(c) Entrances to rooms and other guarded locations containing exposed energized live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

~~(Title 24, Part 3, Section 110-17(c).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2340.18. Arcing Parts.

Parts of electric equipment which in ordinary operation produce arcs, sparks, flames, or molten metal shall be enclosed or separated and isolated from all combustible material.

~~(Title 24, Part 3, Section 110-18.)~~

NOTE: Authority cited: Section 142.3, Labor Code. ~~Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

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§2340.21. Marking.

~~On all electrical equipment, markings shall be provided giving voltage, current, wattage, or other ratings. The marking shall be of sufficient durability to withstand the environment involved.~~

(a) Identification of Manufacturer and Ratings.

Electric equipment shall not be used unless the following markings have been placed on the equipment:

(1) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified; and

(2) Other markings giving voltage, current, wattage, or other ratings.

(b) Durability. The marking shall be of sufficient durability to withstand the environment involved.

~~(Title 24, Part 3, Section 110-24.)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

§2340.22. Identification of Equipment.

~~(a) Each disconnecting means for motors and utilization equipment and for each service, feeder, or branch circuit at the point where it originates shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. The marking shall be of sufficient durability to withstand the environment involved.~~

(a) Motors and Appliances.

Each disconnecting means required by this Safety Order for motors and appliances shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident.

~~(Title 24, Part 3, Section 110-22.)~~

(b) Services, Feeders, and Branch Circuits. Each service, feeder, and branch circuit, at its disconnecting means or overcurrent device, shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident.

~~(Title 24, Part 3, Section 230-77.)~~

(c) ~~(b)~~ Each service disconnecting means shall plainly indicate whether it is in the open or closed position.

~~(e) Each motor controller shall be legibly marked to indicate the motor it controls. Each motor shall have corresponding marking unless located and arranged so that the control point is evident.~~

(d) Durability of Markings. The markings shall be of sufficient durability to withstand the environment involved.

(e) Capable of Accepting a Lock. Effective with installations made after [effective date of these orders] disconnecting means required by these Orders shall be capable of being locked in the open position.

(f) Marking for Series Combination Ratings.

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Effective with installations made after [effective date of these orders]:

(1) Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturer, the equipment enclosures shall be legibly marked in the field to indicate that the equipment has been applied with a series combination rating.

(2) The marking required by subsection (e)(1) of this section shall be readily visible and shall state "Caution--Series Combination System Rated ---- Amperes. Identified Replacement Component Required."

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, ~~Labor Code~~; and ~~Section 18943(c), Health and Safety Code.~~

§2340.23 ~~Openings.~~

~~All openings in boxes, enclosures or fittings shall be effectively guarded or closed to afford protection substantially equivalent to that of the wall of the box, enclosure, or fitting.~~

~~(Title 24, Part 3, Section 3-110-23.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 5. Use and Identification of Grounded and Grounding Conductors

§2350.2. General.

~~(a) Grounded conductors in premises wiring systems shall be identified in a suitable manner.~~

~~(b) The grounded conductor, when insulated, shall have insulation which is suitable, other than color, for any ungrounded conductor of the same circuit.~~

~~(Title 24, Part 3, Section 200 2.)~~

(a) Identification of Conductors.

(1) A conductor used as a grounded conductor shall be identifiable and distinguishable from all other conductors.

(2) A conductor used as an equipment grounding conductor shall be identifiable and distinguishable from all other conductors.

(b) Polarity of Connections. No grounded or grounding conductor shall be attached to any terminal or lead so as to reverse designated polarity.

(c) Use of Grounding Terminals and Devices. A grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug shall not be used for purposes other than grounding.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2350.11. Polarity of Connections. [Repeal]

~~No grounded or grounding conductor shall be attached to any terminal or lead so as to reverse designated polarity.~~

~~(Title 24, Part 3, Section 200 11.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Subchapter 5. Electrical Safety Orders  
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Article 6. Branch Circuits (~~Repealed~~)

§2360.1. Identification of Multiwire Branch Circuits.

For installations built on or after [effective date of these orders] where more than one nominal voltage system exists in a building containing multiwire branch circuits, each ungrounded conductor of a multiwire branch circuit, where accessible, shall be identified by phase and system. The means of identification shall be permanently posted at each branch-circuit panelboard.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2360.2. Receptacles and Cord Connectors.

(a) Receptacles installed on 15- and 20-ampere branch circuits shall be of the grounding type except as permitted for replacement receptacles in subsection (d) of this section. Grounding-type receptacles shall be installed only on circuits of the voltage class and current for which they are rated, except as provided in Table 2360.4(b)(2) and Table 2360.4(b)(3).

(b) Receptacles and cord connectors having grounding contacts shall have those contacts effectively grounded except for receptacles mounted on portable and vehicle-mounted generators in accordance with Section 2395.6 of these Orders and replacement receptacles installed in accordance with subsection (d) of this section.

(c) The grounding contacts of receptacles and cord connectors shall be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacle or cord connector. The branch circuit wiring method shall include or provide an equipment grounding conductor to which the grounding contacts of the receptacle or cord connector shall be connected.

(d) Replacement of receptacles shall comply with the following requirements:

(1) Where a grounding means exists in the receptacle enclosure or a grounding conductor is installed, grounding-type receptacles shall be used and shall be connected to the grounding means or conductor;

(2) Ground-fault circuit-interrupter protected receptacles shall be provided where replacements are made at receptacle outlets that are required to be so protected elsewhere in these Orders; and

(3) Where a grounding means does not exist in the receptacle enclosure, the installation shall comply with one of the following provisions:

(A) A nongrounding-type receptacle may be replaced with another nongrounding-type receptacle; or

(B) A nongrounding-type receptacle may be replaced with a ground-fault circuit-interrupter-type of receptacle that is marked "No Equipment Ground;" an equipment grounding conductor shall not be connected from the ground-fault circuit-interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle; or



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(C) A nongrounding-type receptacle may be replaced with a grounding-type receptacle where supplied through a ground-fault circuit-interrupter; the replacement receptacle shall be marked "GFCI Protected" and "No Equipment Ground;" an equipment grounding conductor shall not be connected to such grounding-type receptacles.

(e) Receptacles connected to circuits having different voltages, frequencies, or types of current (ac or dc) on the same premises shall be of such design that the attachment plugs used on these circuits are not interchangeable.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2360.3. Ground-Fault Circuit Interrupter Protection for Personnel – General Industry.

(a) All 120-volt (nominal), single-phase, 15- and 20-ampere receptacles installed in bathrooms or on rooftops shall have ground-fault circuit-interrupter protection for personnel.

(b) The following requirements apply to temporary wiring installations that are used during maintenance, remodeling, or repair of buildings, structures, or equipment or during similar construction-like activities.

(1) All 120-volt (nominal), single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel.

NOTE 1 to subsection (b)(1): A cord connector on an extension cord set is considered to be a receptacle outlet if the cord set is used for temporary electric power.

NOTE 2 to subsection (b)(1): Cord sets and devices incorporating the required ground-fault circuit-interrupter that are connected to the receptacle closest to the source of power are acceptable forms of protection.

(2) Receptacles other than 120 volt (nominal), single-phase, 15-, 20-, and 30-ampere receptacles that are not part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel.

(3) Where the ground-fault circuit-interrupter protection required by subsection (b)(2) of this section is not available for receptacles other than 120-volt (nominal), single-phase, 15-, 20-, and 30-ampere, the employer shall establish and implement an assured equipment grounding conductor program covering cord sets, receptacles that are not a part of the building or structure, and equipment connected by cord and plug that are available for use or used by employees on those receptacles. This program shall comply with the following requirements:

(A) A written description of the program, including the specific procedures adopted by the employer, shall be available at the jobsite for inspection and copying by the Division of Occupational Safety and Health and any affected employee;

(B) The employer shall designate one or more qualified persons as defined in Section 2300 to implement the program;

(C) Each cord set, attachment cap, plug, and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to

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damage, shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage. Equipment found damaged or defective shall not be used until repaired;

(D) The following tests shall be performed on all cord sets and receptacles which are not a part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded:

1. All equipment grounding conductors shall be tested for continuity and shall be electrically continuous;

2. Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal; and

3. All required tests shall be performed before first use; before equipment is returned to service following any repairs; before equipment is used after any incident which can be reasonably suspected to have caused damage (for example, when a cord set is run over); and at intervals not to exceed 3 months, except that cord sets and receptacles which are fixed and not exposed to damage shall be tested at intervals not exceeding 6 months;

(E) The employer shall not make available or permit the use by employees of any equipment which has not met the requirements of subsection (b)(3) of this section; and

(F) Tests performed as required in subsection (b)(3) of this section shall be recorded. This test record shall identify each receptacle, cord set, and cord- and plug-connected equipment that passed the test and shall indicate the last date it was tested or the interval for which it was tested. This record shall be kept by means of logs, color coding, or other effective means and shall be maintained until replaced by a more current record. The record shall be made available on the jobsite for inspection by the Division and any affected employee.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2360.4. Outlet Devices. Outlet devices shall have an ampere rating not less than the load to be served and shall comply with the following provisions:

(a) Where connected to a branch circuit having a rating in excess of 20 amperes, lampholders shall be of the heavy-duty type. A heavy-duty lampholder shall have a rating of not less than 660 watts if of the admedium type and not less than 750 watts if of any other type; and

(b) Receptacle outlets shall comply with the following provisions:

(1) A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than that of the branch circuit;

(2) Where connected to a branch circuit supplying two or more receptacles or outlets, a receptacle may not supply a total cord- and plug-connected load in excess of the maximum specified in Table 2360.4(b)(2).

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Table 2360.4(b)(2) – Maximum Cord- and Plug-Connected Load to Receptacle

<u>Circuit Rating (Amperes)</u>	<u>Receptacle Rating (Amperes)</u>	<u>Maximum Load (Amperes)</u>
<u>15 or 20</u>	<u>15</u>	<u>12</u>
<u>20</u>	<u>20</u>	<u>16</u>
<u>30</u>	<u>30</u>	<u>24</u>

(3) Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall conform to the values listed in Table 2360.4(b)(3); or, where larger than 50 amperes, the receptacle rating may not be less than the branch-circuit rating.

EXCEPTION: Receptacles for one or more cord- and plug-connected arc welders shall have ampere ratings not less than the minimum branch-circuit conductor ampacity.

Table 2360.4(b)(3) – Receptacle Ratings for Various Size Circuits

<u>Circuit Rating (Amperes)</u>	<u>Receptacle Rating (Amperes)</u>
<u>15</u>	<u>Not over 15</u>
<u>20</u>	<u>15 or 20</u>
<u>30</u>	<u>30</u>
<u>40</u>	<u>40 or 50</u>
<u>50</u>	<u>50</u>

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2360.5. Cord Connections. A receptacle outlet shall be installed wherever flexible cords with attachment plugs are used. Where flexible cords are permitted to be permanently connected, receptacles may be omitted.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
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Article 8. Outdoor Wiring

§2375.1. Scope.

~~This Article applies to covers electric equipment, open wiring and cables located on or attached to the outside of buildings, or run between buildings, other structures or poles. branch-circuit, feeder, and service conductors rated 600 volts, nominal, or less and run outdoors as open conductors.~~

~~(Title 24, Part 3, Section 225-1 without Exception.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2375.7. ~~Lighting Equipment on Poles or Other Structures.~~ Conductors on Poles. Conductors on poles shall have a separation of not less than 1 foot (305 mm) where not placed on racks or brackets. Conductors supported on poles shall provide a horizontal climbing space not less than the following:

(a) Power conductors below communication conductors—30 in. (762 mm);

(b) Power conductors alone or above communication conductors:

(1) 300 volts or less—24 in. (610 mm),

(2) Over 300 volts—30 in. (762 mm);

(c) Communication conductors below power conductors--same as power conductors; and

(d) Communications conductors alone--no requirement.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2375.18. Clearance from Ground.

~~Open wiring and cables shall conform to the following:~~ Open conductors, open multiconductor cables, and service-drop conductors of not over 600 volts, nominal, shall conform to the following minimum clearances:

Installations built before [effective date of these orders]:

Above areas (other than thoroughfares) where it is possible to drive vehicles..... 16 feet (4.88 m)

Above areas accessible to pedestrians only..... 12 feet (3.66 m)

Installations built on or after [effective date of these orders]:

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New Table 2375.18 as follows:

Table 2375.18 Clearances from Ground.

Distance	Installations built on or after [effective date of these orders]	
	Voltage to ground	Conditions
12 ft. (3.66 m)	< 300 V	Above finished grade or sidewalks, or from any platform or projection from which they might be reached. Over residential property and driveways. Over commercial areas subject to pedestrian traffic or to vehicular traffic other than truck traffic.
16 ft. (4.88 m)	301 to 600 V	Over residential property and driveways. Over commercial areas subject to pedestrian traffic or to vehicular traffic other than truck traffic. (This category includes conditions covered under the 12 ft. (3.66 m) category where the voltage exceeds 300 V.)
18 ft. (5.49 m)	< 600 V	
Note: California Public Utilities Commission (CPUC) General Order No. 95 applies in areas subject to CPUC jurisdiction.		

~~(Title 24, Part 3, Section 3-225-18.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2375.19. Clearances from Buildings.

(a) Over roofs. Open wiring and cables shall have a clearance of not less than 8 feet from the highest point of roofs over which they pass.

EXCEPTION: NO. 1: Where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches in 12 inches, a reduction in clearance to 3 feet shall be permitted.

EXCEPTION: NO. 2: Where the voltage between conductors does not exceed 300, a reduction in clearance over the overhanging portion of the roof to 18 inches shall be permitted if:

- a. They do not pass over more than 4 feet of the overhang portion of the roof; and
- b. They are terminated at a (through-the-roof) raceway or approved support.

~~(Title 24, Part 3, Section 3-225-19(a).)~~

EXCEPTION: NO. 3: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of Section 2375.18.

(b) Horizontal Clearances. Open wiring and cables not attached to a building shall have a minimum horizontal clearance of 3 feet.

~~(Title 24, Part 3, Section 3-225-19(b).)~~

(c) Final Spans.

(1) Open wiring and cables to a building they supply or from which they are fed shall be permitted to be attached to the building, but they shall be kept 3 feet from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

(2) Conductors run above the top level of a window shall be permitted to be less than 3 feet above the window provided that they are at the maximum practical distance and that in no case are they less than 1 foot above the window.

~~(Title 24, Part 3, Section 3-225-19(c).)~~

(3) Vertical clearance of final spans above, or within 3.0 feet measured horizontally of, platforms, projections, or surfaces from which they might be reached shall be maintained in accordance with Section 2375.18.

(4) Overhead service conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings, and may not be installed where they will obstruct entrance to these building openings.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2375.25. Location of Outdoor Lamps.

Lamps for outdoor lighting shall be located below all energized conductors, transformers, or other electric equipment, unless such equipment is controlled by a disconnecting means that can be locked in the open position, or unless adequate clearances or other safeguards are provided for relamping operations.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 9. Services

§2380.1 Disconnecting Means.

(a) Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors. The service disconnecting means shall plainly indicate whether it is in the open or closed position and shall be installed at a readily accessible location nearest the point of entrance of the service-entrance conductors.

(b) Each service disconnecting means shall simultaneously disconnect all ungrounded conductors.

(c) Each service disconnecting means shall be suitable for the prevailing conditions.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 10. Overcurrent Protection

§2390.1. General.

Conductors and equipment shall be protected from overcurrent in accordance with their ability to safely conduct current.

~~(Title 24, Part 3, Sections 3 240 2 and 3 240 3.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2390.10. Grounded Conductors.

Except for motor running overload protection, overcurrent devices shall not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2390.20. Disconnecting Means for Fuses.

A disconnecting means shall be provided on the supply side of all fuses in circuits over 150 volts to ground and cartridge fuses in circuits of any voltage where accessible to other than qualified persons so that each individual circuit containing fuses can be independently disconnected from the source of power. However, a current-limiting device without a disconnecting means is permitted on the supply side of the service disconnecting means. In addition, a single disconnecting means is permitted on the supply side of more than one set of fuses as permitted by the exception in Section 2530.112 for group operation of motors, and a single disconnecting means is permitted for fixed electric space-heating equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2390.24. Location.

Overcurrent devices shall be readily accessible to each employee or authorized building management personnel. These overcurrent devices shall not be located where they will be exposed to physical damage or in the vicinity of easily ignitable material.

~~(Title 24, Part 3, Section 240 24(a) without Exceptions.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~



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§2390.41. Arcing or Suddenly Moving Parts.

Arcing or suddenly moving parts shall comply with the following:

(a) Location. Fuses and circuit breakers shall be so located or shielded that persons will not be burned or otherwise injured by their operation.

(b) Suddenly Moving Parts. Handles or levers of circuit breakers, and similar parts which may move suddenly in such a way that persons in the vicinity are likely ~~liable~~ to be injured by being struck by them, shall be guarded or isolated.

~~(Title 24, Part 3, Section 240-41.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2390.81. ~~Indicating-~~ Circuit Breakers.

(a) Circuit breakers shall clearly indicate whether they are in the open “off” or closed “on” position.

(b) Where circuit breaker handles on switchboards or in panelboards are operated vertically rather than rotationally or horizontally, the up position of the handle shall be the “on” position.

~~(Title 24, Part 3, Section 240-81.)~~

(c) ~~§2390.83-~~ Circuit Breakers Used as Switches.

Where used as switches in 120-volt and 277-volt fluorescent lighting circuits, circuit breakers shall be listed ~~approved for the purpose~~ and shall be marked “SWD.” ~~(Title 24, Part 3, Section 240-83(d).)~~

(d) Applications.

(1) A circuit breaker with a straight voltage rating, such as 240 V or 480 V, shall only be installed in a circuit in which the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used for protecting a 3-phase, corner-grounded delta circuit unless the circuit breaker is marked 1 $\phi$  - 3 $\phi$  to indicate such suitability.

(2) A circuit breaker with a slash rating, such as 120/240 V or 480Y/277 V, shall only be installed in a circuit where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the circuit breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2390.83. Circuit Breakers Used as Switches.

~~Where used as switches in 120-volt and 277-volt fluorescent lighting circuits, circuit breakers shall be approved for the purpose and shall be marked "SWD."~~

~~(Title 24, Part 3, Section 240.83(d).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 11. Grounding

§2395.3. Direct-Current Systems.

Systems to be Grounded. Systems that supply premises wiring shall be grounded as follows:

(a) Two-Wire Direct Current Systems. Two-wire DC systems ~~supplying premises wiring~~ operating at over 50 volts through 300 volts between conductors shall be grounded.

~~EXCEPTIONS: No. 1:~~ A system equipped with a ground detector and supplying only industrial equipment in limited areas.

~~EXCEPTION: No. 2:~~ A system operating at 50 volts or less between conductors.

~~EXCEPTION: No. 3:~~ A system operating at over 300 volts between conductors.

2. EXCEPTION: No. 4: A rectifier derived DC system supplied from a grounded AC system complying with Section 2395.5.

3. EXCEPTION: No. 5: DC Fire Alarm ~~Protective Signaling~~ Circuits having a maximum current of 0.030 amperes.

(b) Three-Wire Direct-Current Systems. The neutral conductor of all 3-wire DC systems ~~supplying premises wiring~~ shall be grounded.

~~(Title 24, Part 3, Section 250-3).~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.5. Alternating-Current Circuits and Systems to Be Grounded.

AC circuits and systems supplying premises wiring shall be grounded as provided for in this Section.

(a) AC circuits of less than 50 volts shall be grounded under any of the following conditions:

(1) Where supplied by transformers if the transformer primary supply system exceeds 150 volts to ground.

(2) Where supplied by transformers if the transformer primary supply system is ungrounded.

(3) Where installed as overhead conductors outside of buildings.

(b) AC systems of 50 volts or more ~~supplying premises wiring and premises wiring systems~~ shall be grounded under any of the following conditions:

(1) Where the system can be so grounded that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts.

(2) Where the system voltage is rated ~~480Y/277~~, 3-phase, 4-wire wye-connected in which the neutral is used as a circuit conductor.

(3) Where the system voltage is rated ~~240/120~~, 3-phase, 4-wire delta-connected in which the midpoint of one phase is used as a circuit conductor.

(4) Where a service conductor is uninsulated.

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EXCEPTIONS: AC systems of 50 volts or more are not required to be grounded under any of the following conditions:

~~No. 1:~~ Electric systems used exclusively to supply industrial electric furnaces for melting, refining, tempering, and the like.

~~EXCEPTION: No. 2:~~ Separately derived systems used exclusively for rectifiers supplying only adjustable speed industrial drives.

~~EXCEPTION: No. 3:~~ Separately derived systems supplied by transformers that have a primary voltage rating less than 1000 volts provided that all of the following conditions are met:

- a. The system is used exclusively for control circuits.
- b. The conditions of maintenance and supervision assure that only qualified persons will service the installation.
- c. Continuity of control power is required.
- d. Ground detectors are installed on the control system.

~~EXCEPTION: No. 4:~~ Isolated power systems that supply circuits as ~~permitted~~ in health care facilities.

5. The system is a high-impedance grounded neutral system in which a grounding impedance, usually a resistor, limits the ground-fault current to a low value for 3-phase ac systems of 480 volts to 1000 volts provided all of the following conditions are met:

(a) The conditions of maintenance and supervision ensure that only qualified persons will service the installation;

(b) Continuity of power is required;

(c) Ground detectors are installed on the system; and

(d) Line-to-neutral loads are not served.

~~NOTE: The proper use of suitable ground detectors on ungrounded systems can provide additional protection.~~

~~(e) Separately Derived Systems. A premises wiring system, which is required to be grounded in Subsections (a) or (b) above and whose power is derived from generator, transformer, or convertor windings, shall be grounded. However, a separate system ground shall not be required where there is a direct electrical connection, including a solidly grounded circuit conductor, to supply conductors originating in another supply system.~~

~~Title 24, Part 3, Section 250.5(a), (b), (d).)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

§2395.6. Portable and Vehicle-Mounted Generators.

~~(a) Under the following conditions, the frame of a portable or a vehicle mounted generator need not be grounded and shall be permitted to serve as the grounding electrode for a system supplied by the generator:~~

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~~(1) The noncurrent-carrying metal parts of equipment located on the vehicle and the equipment grounding conductor terminals of the receptacles are bonded to the generator or vehicle frame, and~~

~~(2) The generator supplies only equipment located on the vehicle or the generator and/or cord- and plug-connected equipment through receptacles mounted on the vehicle or on the generator, and~~

~~(3) The frame of a vehicle-mounted generator is bonded to the vehicle frame, or~~

~~(4) The generator is single phase, portable or vehicle mounted, rated not more than 5 KW, and the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces.~~

(a) The frame of a portable generator need not be grounded and may serve as the grounding electrode for a system supplied by the generator under the following conditions:

(1) The generator supplies only equipment mounted on the generator or cord- and plug-connected equipment through receptacles mounted on the generator, or both; and

(2) The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame, and

(3) The generator is single-phase, portable, rated not more than 5 KW, and the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces.

(b) The frame of a vehicle need not be grounded and may serve as the grounding electrode for a system supplied by a generator located on the vehicle under the following conditions:

(1) The frame of the generator is bonded to the vehicle frame, and

(2) The generator supplies only equipment located on the vehicle and cord- and plug-connected equipment through receptacles mounted on the vehicle, and

(3) The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame, and

(4) The system complies with all other provisions of Article 11 of these Low-Voltage Electrical Safety Orders, and

(5) The generator is single-phase, vehicle-mounted, rated not more than 5 KW, and the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces.

(c) A system conductor that is required to be grounded by the provisions of Section 2395.25 shall be bonded to the generator frame where the generator is a component of a separately derived system.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2395.7. Circuits Not to Be Grounded. [Repeal]

~~Circuits for electric cranes operating over combustible fibers in Class III locations shall not be grounded.~~

~~(Title 24, Part 3, Section 250 7(a).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

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LOCATION OF SYSTEM GROUNDING CONNECTIONS

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§2395.23. Grounding Connections ~~for Alternating Current Systems.~~

(a) For a grounded system, a grounding electrode conductor shall be used to connect both the equipment grounding conductor and the grounded circuit conductor to the grounding electrode. Both the equipment grounding conductor and the grounding electrode conductor shall be connected to the grounded circuit conductor on the supply side of the service disconnecting means, or on the supply side of the system disconnecting means or overcurrent devices if the system is separately derived.

~~(Title 24, Part 3, Section 250-23.)~~

(b) For an ungrounded service-supplied system, the equipment grounding conductor shall be connected to the grounding electrode conductor at the service equipment. For an ungrounded separately derived system, the equipment grounding conductor shall be connected to the grounding electrode conductor at, or ahead of, the system disconnecting means or overcurrent devices.

(c) On extensions of existing branch circuits that do not have an equipment grounding conductor, grounding-type receptacles may be grounded to a grounded cold water pipe near the equipment if the extension was installed before [effective date of this standard].

(1) When any element of this branch circuit is replaced, the entire branch circuit shall use an equipment grounding conductor that complies with all other provisions of Article 11.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.25. Conductor to Be Grounded-- Alternating-Current Systems.

For AC premises wiring systems the ~~identified conductor shall be grounded.~~ required to be grounded by Section 2395.5 shall be as follows:

(a) One conductor of a single-phase, two-wire system shall be grounded;

(b) The neutral conductor of a single-phase, three-wire system shall be grounded;

(c) The common conductor of a multiphase system having one wire common to all phases shall be grounded;

(d) One phase conductor of a multiphase system where one phase is grounded shall be grounded; and

(e) The neutral conductor of a multiphase system in which one phase is used as a neutral conductor shall be grounded.

~~(Title 24, Part 3, Section 250-25.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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ENCLOSURE GROUNDING

§2395.32. Supports, Enclosures, and Equipment to be Grounded. ~~Service Raceways and Enclosures.~~

~~Metal enclosures for service conductors and equipment shall be grounded.~~

~~(Title 24, Part 3, Section 250-32.)~~

(a) Metal cable trays, metal raceways, and metal enclosures for conductors shall be grounded, except that:

(1) Metal enclosures such as sleeves that are used to protect cable assemblies from physical damage need not be grounded; and

(2) Metal enclosures for conductors added to existing installations of open wire, knob-and-tube wiring, and nonmetallic-sheathed cable need not be grounded if all of the following conditions are met:

(A) Runs are less than 25.0 feet (7.62 meters);

(B) Enclosures are free from probable contact with ground, grounded metal, metal laths, or other conductive materials; and

(C) Enclosures are guarded against employee contact.

(b) Metal enclosures for service equipment shall be grounded.

(c) Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and metal outlet or junction boxes that are part of the circuit for these appliances shall be grounded.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.33. Other Conductor Enclosures. [Repeal].

~~Metal enclosures for other than service conductors shall be grounded.~~

~~EXCEPTION: Metal enclosures used to protect cable assemblies from physical damage shall not be required to be grounded where installed in a dry location.~~

~~(Title 24, Part 3, Section 250-33 without Exception 1.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

EQUIPMENT GROUNDING

§2395.42. Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed).

Exposed noncurrent-carrying metal parts of fixed equipment that may likely to become energized under abnormal conditions shall be grounded under any of the following conditions; specified in (a) through (g) below.



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- (a) Where within 8 feet vertically or 5 feet horizontally of ground or grounded metal objects and subject to contact by persons.
- (b) Where located in a wet or damp location and not isolated.
- (c) Where in electrical contact with metal.
- (d) Where in a hazardous (classified) location as covered by Article 59.
- (e) Where supplied by a metal-clad, metal-sheathed, or grounded metal-raceway wiring method; ~~except as permitted by Section 2395.33 for short sections of raceway.~~
- (f) Where equipment operates with any terminal at over 150 volts to ground.
- (g) Grounding of equipment mounted on poles shall comply with the Rules of Overhead Electric Line Construction of the California Public Utilities Commission, General Order No. 95. ~~(Title 24, Part 3, Sections 250-42(a)-(f) and 3-250-42(g).)~~

EXCEPTIONS to Section 2395.42: Exposed noncurrent-carrying metal parts of the following types of fixed equipment need not be grounded:

1. Enclosures for switches or circuit breakers used for other than service equipment and accessible to qualified persons only;
2. Electrically heated appliances that are permanently and effectively insulated from ground;
3. Distribution apparatus, such as transformer and capacitor cases, mounted on wooden poles, at a height exceeding 8 feet (2.44 m) above ground or grade level; and
4. Listed equipment protected by a system of double insulation, or its equivalent, and distinctively marked as such.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.43. Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed)--  
Specific. [Repeal]

~~Exposed, noncurrent-carrying metal parts of the kinds of equipment described in (a) through (j) below, regardless of voltage, shall be grounded:~~

~~(a) Switchboard frames and structures supporting switching equipment.~~

~~EXCEPTION: Frames of DC, single-polarity switchboards where effectively insulated, and marked "Switchboard Frame Not Grounded," or equivalent wording.~~

~~(b) Generator and motor frames in an electrically operated organ.~~

~~EXCEPTION: Where the generator is effectively insulated from ground and from the motor driving it, and marked "Generator Frame Not Grounded," or equivalent wording.~~

~~(c) Motor frames.~~

~~(d) Enclosures for motor controllers~~

~~EXCEPTION: Lined covers of snap switches.~~

~~(e) Electric equipment for elevators and cranes.~~

~~(f) Electric equipment in garages, theaters, and motion picture studios.~~

~~EXCEPTION: Electric equipment specifically exempted by Section 2553.20.~~

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~~(g) Electric signs and associated equipment.~~

~~EXCEPTION: Where insulated from ground and from other conductive objects and accessible only to qualified persons.~~

~~(h) Motion picture projection equipment.~~

~~(i) Equipment supplied by Class 1, Class 2 and Class 3 remote control and signalling circuits where required to be grounded by Sections 2395.3 and 2395.5 of this Article.~~

~~(j) Lighting fixtures.~~

~~(Title 24, Part 3, Section 250-43.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.44. Nonelectrical Equipment.

The metal parts of nonelectrical equipment described in (a) through ~~(e)~~ (d) below shall be grounded.

(a) Frames and tracks of electrically operated cranes and hoists.

(b) Frames of nonelectrically driven elevator cars to which electric conductors are attached.

(c) Metal partitions, grill work, and similar metal enclosures around equipment.

(d) Hand-operated metal shifting ropes or cables of electric elevators.

~~(Title 24, Part 3, Section 250.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2395.45. Equipment Connected by Cord and Plug.

(a) The exposed noncurrent-carrying metal parts of ~~the following~~ cord- and plug-connected equipment that may become energized shall be grounded under any of the following conditions: ~~where such exposed metal parts are likely to become energized:~~

(1) (5) Utilization equipment used in hazardous (classified) locations (See Article 59).

(2) (6) Any electric equipment which is operated at over 150 volts to ground.

(3) If the equipment is of the following types:

(A) (1) Refrigerators, freezers, and air conditioners.

(B) (2) Clothes-washing, clothes-drying and dishwashing machines, sump pumps, and electrical aquarium equipment.

(C) Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools.

(D) (3) Portable, hand-held, motor-operated tools and utilization equipment of the following types: such as drills, hedge clippers, lawn mowers, snow blowers, wet scrubbers, sanders and saws.

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(E) (4) Cord- and plug-connected appliances ~~Utilization equipment~~ used in damp or wet locations or by persons standing on the ground or on metal or exposed concrete floors or working inside of metal tanks or boilers.

(F) (8) Portable and mobile x-ray and associated equipment.

(G) (7) Portable hand lamps.

(H) Tools likely to be used in wet and conductive locations.

~~(b)~~ EXCEPTIONS to 2395.45: The following equipment shall not be required to be grounded:

(1) Listed portable tools or utilization equipment likely to be used in wet and conductive locations if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts.

(2) Listed or labeled portable tools and utilization equipment protected by an approved system of double insulation. Where such a system is employed, the equipment shall be distinctively marked.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

METHODS OF GROUNDING

§2395.50. Equipment Grounding Connections. [Repeal]

~~The grounding connection for metal noncurrent-carrying equipment shall be made on the supply side of the service disconnecting means or as outlined in Section 2395.5(c) if for a separately derived system.~~

~~(a) For Grounded System. The connection shall be made by bonding the equipment grounding conductor to the grounded circuit conductor and the grounding electrode conductor.~~

~~(b) For Ungrounded System. The connection shall be made by bonding the equipment grounding conductor to the grounding electrode conductor.~~

~~EXCEPTION: For replacement of nongrounding type receptacles with grounding type receptacles and for branch circuit extensions only in existing installations which do not have a grounding conductor in the branch circuit, the grounding conductor of a grounding type receptacle outlet shall be permitted to be grounded to a grounded cold water pipe near the equipment.~~

~~(Title 24, Part 3, Section 250-50.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.-~~

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§2395.57. Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed)--Grounding.

Noncurrent-carrying metal parts of fixed equipment, raceways, and other enclosures, where required to be grounded, shall be grounded by an equipment grounding conductor that is contained within the same raceway, cable, or cord, or runs with or encloses the circuit conductors. For dc circuits only, the equipment grounding conductor may be run separately from the circuit conductors.

one of the methods indicated in (a) or (b) below:

~~(a) By any of the equipment grounding conductors permitted by Section 250-91(b), Part 3, Title 24, California Administrative Code.~~

~~(b) By an equipment grounding conductor contained within the same raceway, cable, or cord or otherwise run with the circuit conductors. Bare, covered or insulated equipment grounding conductors shall be permitted. Individually covered or insulated grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes.~~

~~EXCEPTION: No. 1: An insulated conductor larger than No. 6 shall, at the time of installation, be permitted to be permanently identified as a grounding conductor at each end and at every point where the conductor is accessible. Identification shall be accomplished by one of the following:~~

~~a. Stripping the insulation from the entire exposed length,~~

~~b. Coloring the exposed insulation green, or~~

~~c. Marking the exposed insulation with green colored tape or green colored adhesive labels.~~

~~EXCEPTION: No. 2: For direct current circuits only, the equipment grounding conductor shall be permitted to be run separately from the circuit conductors.~~

~~EXCEPTION: No. 3: Where the conditions of maintenance and supervision assure that only qualified persons will service the installation, an insulated conductor in a multiconductor cable shall, at the time of installation, be permitted to be permanently identified as a grounding conductor at each end and at every point where the conductor is accessible by one of the following means:~~

~~a. Stripping the insulation from the entire exposed length,~~

~~b. Coloring the exposed insulation green, or~~

~~c. Marking the exposed insulation with green tape or green colored adhesive labels.~~

~~NOTE: See Section 2395.79 for equipment bonding jumper requirements.~~

~~(Title 24, Part 3, Section 250-57.)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

§2395.58. Electric Equipment Considered Effectively Grounded.

The following electric ~~noncurrent-carrying~~ equipment, under the conditions specified in (a) and (b) below, shall be considered effectively grounded:

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(a) ~~Equipment Secured to Grounded Structural Metal.~~ Electric equipment secured to, and in electrical contact with, a metal rack or structure that is provided for its support and the metal rack or structure is grounded by the method specified for the noncurrent-carrying metal parts of fixed equipment in one of the means indicated in Section 2395.57. ~~The structural metal frame of a building shall not be used as the required AC equipment grounding conductor for installations made after February 25, 1993.~~

(1) For installations made before April 16, 1981, electric equipment is also considered to be effectively grounded if it is secured to, and in metallic contact with, the grounded structural metal frame of a building. The structural metal frame of a building shall not be used as the required AC equipment grounding conductor for installations made on or after April 16, 1981.

(2) Effective with installations on or after April 16, 1981, when any element of this branch circuit is replaced, the entire branch circuit shall use an equipment grounding conductor that complies with all other provisions of Article 11 of these Safety Orders.

(b) Metal Car Frames. Metal car frames supported by metal hoisting cables attached to or running over metal sheaves or drums of grounded elevator machines.

~~(Title 24, Part 3, Section 250-58.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Subchapter 5. Electrical Safety Orders

Group 1. Low-Voltage Electrical Safety Orders

Article 12. Wiring Methods, Components, and Equipment for General Use. ~~(Repealed)~~

§2400.1. Scope. The provisions of this Article do not apply to conductors that are an integral part of factory-assembled equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2400.2. General Requirements.

(a) Metal raceways, cable trays, cable armor, cable sheath, enclosures, frames, fittings, and other metal noncurrent-carrying parts that are to serve as grounding conductors, with or without the use of supplementary equipment grounding conductors, shall be effectively bonded where necessary to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings designed so as to make such removal unnecessary.

(b) Where necessary for the reduction of electrical noise (electromagnetic interference) of the grounding circuit, an equipment enclosure supplied by a branch circuit may be isolated from a raceway containing circuits supplying only that equipment by one or more listed nonmetallic raceway fittings located at the point of attachment of the raceway to the equipment enclosure. The metal raceway shall be supplemented by an internal insulated equipment grounding conductor installed to ground the equipment enclosure.

(c) No wiring systems of any type may be installed in ducts used to transport dust, loose stock, or flammable vapors. No wiring system of any type may be installed in any duct used for vapor removal or for ventilation of commercial-type cooking equipment, or in any shaft containing only such ducts.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 13. Temporary Wiring

§2405.1. Scope.

~~The provisions of this Article apply to temporary wiring methods other than those permitted for permanent installations in Subsection 2305.2(d).~~

Except as specifically modified in this Article, all other requirements of this Order for permanent wiring shall also apply to temporary wiring installations ~~used during:~~

(a) Temporary electrical power and lighting installations of 600 volts, nominal, or less may be used only as follows:

(1) ~~(a)~~ During and for tThe period of construction, remodeling, maintenance, repairs, or demolition of buildings, structures, equipment or similar activities; or

(2) ~~(b)~~ The For a period not to exceed 90 days for ~~of~~ work associated with non-permanent work locations, such as carnivals, music festivals, Christmas decorative lighting, Christmas tree lots, and similar purposes; ~~etc.~~; or

(3) ~~(c)~~ For tThe period of work associated with experimental or developmental work and during emergencies.

(b) Temporary wiring shall be removed immediately upon completion of the project or purpose for which the wiring was installed.

(c) Temporary electrical installations of more than 600 volts shall be in accordance with the High-Voltage Electrical Safety Orders.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2405.2. General Requirements for Temporary Wiring.

(a) Feeders. The following requirements apply to feeders:

(1) Feeders shall originate in an approved distribution center.

(2) Conductors shall be run as multi-conductor cord or cable assemblies. However, if installed as permitted in Section 2405.1(a)(3), and if accessible only to qualified persons, feeders may be run as single insulated conductors.

(b) Branch Circuits. The following requirements apply to branch circuits:

(1) Branch circuits shall originate in an approved power outlet or panelboard.

(2) Conductors shall be multiconductor cord or cable assemblies or open conductors. If run as open conductors, they shall be fastened at ceiling height every 10 feet (3.05 m).

(3) No branch-circuit conductor may be laid on the floor.

(4) Each branch circuit that supplies receptacles or fixed equipment shall contain a separate equipment grounding conductor if run as open conductors.

~~(b) Multi-conductor cords and cables shall be hard service type or equivalent, with multi-conductor fittings.~~

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(c) Receptacles. Receptacles shall be of the grounding type. Unless installed in a continuous grounded metallic raceway or metallic covered cable, each branch circuit shall contain a separate equipment grounding conductor and all receptacles shall be electrically connected to the grounding conductor.

~~(c) Earth Returns. No earth returns shall be used for temporary circuit wiring nor for equipment grounding.~~

~~(d) (a) Insulated single conductors, approved for the purpose and suitably supported, shall be permitted to be run as open conductors where not subject to mechanical injury. No bare conductors nor earth returns shall be used for the wiring of any temporary circuit wiring.~~

(e) Disconnecting means. Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit. Multiwire branch circuits shall be provided with a means to disconnect simultaneously all ungrounded conductors at the power outlet or panelboard where the branch circuit originated.

NOTE for Section 2405.2(e): Circuit breakers with their handles connected by approved handle ties are considered a single disconnecting means for the purpose of this requirement.

~~(e) Open wire taps, not exceeding 6 inches in length, may be made from permanent wiring outlet boxes to supply approved lampholders.~~

~~(f) (d) Lamps. Lamps shall be so located or guarded that personnel are protected from accidental contact. Protection shall be provided by location of at least 7 feet vertically or 3 feet horizontally from normal working surfaces or by suitable fixtures or lamp guards.~~

All lamps for general illumination shall be protected from accidental contact or breakage by a suitable fixture or lampholder with a guard. Brass shell, paper-lined sockets, or other metal-cased sockets may not be used unless the shell is grounded.

(g) (f) Physical Protection. Flexible cords and cables shall be protected from accidental damage. Sharp corners and projections shall be avoided. When passing through doorways or other pinch points, protection shall be provided to avoid damage.

(h) (b) Multi-conductor cords and cables shall be hard service type or equivalent, with multi-conductor fittings.

~~(g) Grounding. Temporary wiring installations specified in Section 2405.1(b) shall be grounded to grounding electrode or to the grounding electrode of a permanent wiring system.~~

(i) Cable assemblies and flexible cords and cables shall be supported in place at intervals that ensure that they will be protected from physical damage. Support shall be in the form of staples, cables ties, straps, or similar type fittings installed so as not to cause damage.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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**§2405.4. Ground-Fault Circuit Protection-Construction Site.**

(a) General. For purposes of this Section, a construction site is a place of employment where erection, demolition, modification, alteration or excavation is being performed on a building, structure or underground facility, other than mining.

(b) Construction Sites. To protect employees on construction sites, the employer shall use either or both ground-fault circuit interrupters as specified in Subsection (c) of this Section or an assured equipment grounding conductor program as specified in Subsection (d) of this Section. These requirements are in addition to any other requirements for equipment grounding conductors.

EXCEPTION: An individual cord set, supplied from a receptacle on a 15- or 20-ampere branch circuit which is part of the permanent wiring of that building or structure, shall not be required to comply with Section 2405.4(c) or (d).

(c) Ground-Fault Circuit Interrupters. All 120-volt, AC, single-phase, 15- and 20-ampere receptacle outlets on construction sites, which are not a part of the permanent wiring of the building or structure and which are in use by employees, shall have approved ground-fault circuit interrupters for personnel protection. Receptacles on a two-wire, single phase portable or vehicle-mounted generator rated not more than 5 KW, where the circuit conductors of the generator are insulated from the generator frame and all their grounded surfaces, need not be protected with ground-fault circuit interrupters.

Feeders supplying 15- and 20-ampere receptacle branch circuits shall be permitted to be protected by a ground-fault circuit interrupter approved for the purpose in lieu of the above provisions.

(d) Assured Equipment Grounding Conductor Program. The employer shall establish and implement an assured equipment grounding conductor program on construction sites covering all 120-volt, AC, single-phase, cord sets, receptacles which are not a part of the permanent wiring of the building or structure and equipment connected by cord and plug, which are used by employees. This program shall comply with the following minimum requirements:

(1) A written description of the program, including the specific procedures adopted by the employer shall be available at the job site for inspection and copying by the Division of Occupational Safety and Health and any affected employee.

(2) The employer shall designate one or more qualified persons as defined in Section 2300 to implement the program.

(3) Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug including these which are not required to be grounded, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects, such as, deformed or missing pins or insulation damage, and for indication of possible internal damage. Equipment found damaged or defective shall not be used until repaired.

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(4) The following tests shall be performed on all cord sets and receptacles which are not a part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded:

NOTE: Double-insulated tools or other similar equipment are not required to be grounded. See Section 2395.45(d)(5).

(A) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

(B) Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

(5) All tests required in Subsection (d)(4) shall be performed:

(A) Before first use for newly acquired equipment;

(B) Before equipment is returned to service following any repairs;

(C) Before equipment is used after any incident which can be reasonably suspected to have caused damage (for example, when a cord set is run over); and

(D) At intervals not to exceed three (3) months, except that cord sets and receptacles which are fixed and not exposed to damage shall be tested at intervals not exceeding 6 months.

(6) The employer shall not make available or permit the use by employees of any equipment which has not met the requirements of Subsection (d) of this Section.

(7) Receptacles, cord sets and cord- and plug-connected equipment passing the tests required in Subsection (d) shall be identified. Identification may be made by means of logs, color coding or other effective means, shall be maintained until replaced by a more current identification, and shall indicate the last test date or the interval for which the tests were performed. These dates or intervals shall be readily available to the Division of Occupational Safety and Health and affected employees.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 15. Cable Trays

§2418.2. Uses Permitted. (Repealed) Wiring Methods.

Only the following wiring methods may be installed in cable tray systems: armored cable; electrical metallic tubing; electrical nonmetallic tubing; fire alarm cables; flexible metal conduit; flexible metallic tubing; instrumentation tray cable; intermediate metal conduit; liquidtight flexible metal conduit; liquidtight flexible nonmetallic conduit; metal-clad cable; mineral-insulated, metal-sheathed cable; multiconductor service-entrance cable; multiconductor underground feeder and branch-circuit cable; multipurpose and communications cables; nonmetallic-sheathed cable; power and control tray cable; power-limited tray cable; optical fiber cables; and other factory-assembled, multiconductor control, signal, or power cables that are specifically approved for installation in cable trays, rigid metal conduit, and rigid nonmetallic conduit.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2418.3. Industrial Establishments.

In industrial establishments where conditions of maintenance and supervision assure that only qualified persons will service the installed cable tray system, the following cables may also be installed in ladder, ventilated-trough, or ventilated-channel cable trays:

(a) Single conductor cable.

(1) Single conductor cable shall be No. 1/0 or larger and shall be of a type listed and marked on the surface for use in cable trays; where Nos. 1/0 through 4/0 single conductor cables are installed in ladder cable tray, the maximum allowable rung spacing for the ladder cable tray shall be 9 in. (229 mm); where exposed to direct rays of the sun, cables shall be identified as being sunlight resistant;

(2) Welding cables installed in dedicated cable trays;

(3) Single conductors used as equipment grounding conductors; these conductors, which may be insulated, covered, or bare, shall be No. 4 or larger; and

(b) Multiconductor cable, Type MV; where exposed to direct rays of the sun, the cable shall be identified as being sunlight resistant.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2418.4. Equipment Grounding Conductors.

Metallic cable trays may be used as equipment grounding conductors only where continuous maintenance and supervision ensure that qualified persons will service the installed cable tray system.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2418.5. Hazardous (Classified) Locations. Cable trays in hazardous (classified) locations may contain only the cable types permitted in such locations. (See Article 59.)

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2418.6. Uses Not Permitted.

Cable tray systems may not be used in hoistways or where subjected to severe physical damage.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 16. Open Wiring on Insulators

§2420.3. Exposed Wiring, Uses Permitted.

(a) Scope. Open exposed wiring shall not be installed in any building or portion of a building except:

(1) In substations, transformer vaults, transformer enclosures, on the supply side of electric furnace electrodes, or in tunnels or similar locations, where such spaces are restricted to electrical use and are accessible to qualified and authorized persons only.

~~(Title 24, Part 3, Section 3-320.3 exception.)~~

(2) For insulated conductors as permitted in Article 13; Temporary Wiring.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2420.4. Conductor Supports.

(a) Conductors smaller than No. 8 shall be rigidly supported on noncombustible, nonabsorbent insulating materials and may not contact any other objects. Supports shall be installed as follows:

(1) Within 6 in. (152 mm) from a tap or splice;

(2) Within 12 in. (305 mm) of a dead-end connection to a lampholder or receptacle; and

(3) At intervals not exceeding 4.5 ft. (1.37 m), and at closer intervals sufficient to provide adequate support where likely to be disturbed.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2420.5. Flexible Nonmetallic Tubing.

In dry locations, where not exposed to severe physical damage, conductors may be separately enclosed in flexible nonmetallic tubing. The tubing shall be in continuous lengths not exceeding 15 feet (4.57 m) and secured to the surface by straps at intervals not exceeding 4.5 feet (1.37 m).

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2420.6. Penetrations of Walls, Floors, Wood Cross Members, etc.

Open conductors shall be separated from contact with walls, floors, wood cross members, or partitions through which they pass by tubes or bushings of noncombustible, nonabsorbent insulating material. If the bushing is shorter than the hole, a waterproof sleeve of nonconductive material shall be inserted in the hole and an insulating bushing slipped into the sleeve at each end in such a manner as to keep the conductors absolutely out of contact with the sleeve. Each conductor shall be carried through a separate tube or sleeve.

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NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2420.7. Protection from Physical Damage.

Where open conductors cross ceiling joints or wall studs and are exposed to physical damage (for example, located within 7 feet (2.13 m) of the floor), they shall be protected.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 45. Cabinets, ~~and Cutout Boxes, and Fittings~~

§2473.1. Conductors Entering Boxes, Cabinets, or Fittings.

- (a) Conductors entering cutout boxes, cabinets, or fittings shall be protected from abrasion, and openings through which conductors enter shall be effectively closed.
- (b) Unused openings in cabinets, boxes, and fittings shall be effectively closed.
- (c) Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure. However, where cable with an entirely nonmetallic sheath enters the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 18 in. (457 mm) or more than 10 feet (3.05 m) in length, the cable need not be secured to the cabinet, box, or enclosure provided all of the following conditions are met:
- (1) Each cable is fastened within 12 in. (305 mm) of the outer end of the raceway, measured along the sheath;
- (2) The raceway extends directly above the enclosure and does not penetrate a structural ceiling;
- (3) A fitting is provided on each end of the raceway to protect the cable from abrasion, and the fittings remain accessible after installation;
- (4) The raceway is sealed or plugged at the outer end using approved means so as to prevent access to the enclosure through the raceway;
- (5) The cable sheath is continuous through the raceway and extends into the enclosure not less than 0.25 in. (6.35 mm) beyond the fitting;
- (6) The raceway is fastened at its outer end and at other points as necessary; and
- (7) Where installed as conduit or tubing, the allowable cable fill does not exceed that permitted for complete conduit or tubing systems.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2473.2. Covers and Canopies.

- (a) All pull boxes, junction boxes, and fittings shall be provided with covers identified for the purpose. If metal covers are used, they shall be grounded. In completed installations, each outlet box shall have a cover, faceplate, or fixture canopy. Covers of outlet boxes having holes through which flexible cord pendants pass shall be provided with bushings designed for the purpose or shall have smooth, well-rounded surfaces on which the cords may bear.
- (b) Where a fixture canopy or pan is used, any combustible wall or ceiling finish exposed between the edge of the canopy or pan and the outlet box shall be covered with noncombustible material.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 47. Switches

§2480.5. Single-throw Knife Switches.

Single-throw knife switches shall be so placed that gravity will not tend to close them. Single-throw knife switches approved for use in the inverted position shall be provided with a locking device that will ensure that the blades remain in the open position when so set.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2480.6. Double-Throw Position of Knife Switches.

~~Single-throw knife switches shall be so placed that gravity will not tend to close them.~~ Double-throw knife switches shall be permitted to be mounted so that the throw will be either vertical or horizontal. ~~However, w~~Where the throw is vertical, a locking device shall be provided that will insure the blades remaining in the open position when so set.

~~(Title 24, Part 3, Section 380-6.)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

§2480.7. Connection of Knife Switches.

(a) Single-throw knife switches and switches with butt contacts shall be so connected that the blades are deenergized dead when the switch is in the open position.

~~(Title 24, Part 3, Section 380-7.)~~

(b) For installations built on or after [effective date of these orders] single-throw knife switches, molded-case switches, switches with butt contacts, and circuit breakers used as switches shall be connected so that the terminals supplying the load are deenergized when the switch is in the open position.

EXCEPTION: Blades and terminals supplying the load of a switch may be energized when the switch is in the open position where the switch is connected to circuits or equipment inherently capable of providing a backfeed source of power. For such installations, a permanent sign shall be installed on the switch enclosure or immediately adjacent to open switches that read, "WARNING--LOAD SIDE TERMINALS MAY BE ENERGIZED BY BACKFEED."

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~



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§2480.8. Accessibility and Grouping. [Repeal]

~~Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.~~

~~(Title 24, Part 3, Section 380 8.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

§2480.9. Snap Switches.

(a) Faceplates for flush-mounted snap switches. Snap switches mounted in boxes shall have faceplates installed so as to completely cover the opening and seat against the finished surface.

(b) Grounding. For installations built on or after [effective date of these orders] snap switches, including dimmer switches, shall be effectively grounded and shall provide a means to ground metal faceplates, whether or not a metal faceplate is installed. However, if no grounding means exists within the snap-switch enclosure, or where the wiring method does not include or provide an equipment ground, a snap switch without a grounding connection is permitted for replacement purposes only. Such snap switches shall be provided with a faceplate of nonconducting, noncombustible material if they are located within reach of conducting floors or other conducting surfaces.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 48. Switchboards and Panelboards

§2484.5. Switchboards with Exposed Live Parts.

Switchboards that have any exposed live parts shall be located in permanently dry locations and shall be accessible only to qualified persons.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2484.6. Panelboard Enclosures.

Panelboards shall be mounted in cabinets, cutout boxes, or enclosures designed for the purpose and shall be dead front. However, panelboards other than the dead front externally-operable type are permitted where accessible only to qualified persons.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2484.24. Knife Switches Mounted in Switchboards or Panelboards.

Exposed blades of knife switches mounted in switchboards or panelboards shall be dead when open.

~~(Title 24, Part 3, Section 384-24.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 48.1. Enclosures for Damp or Wet Locations

§2485.1. Cabinets, Cutout Boxes, Fittings, Boxes, and Panelboard Enclosures.

(a) Cabinets, cutout boxes, fittings, boxes, and panelboard enclosures in damp or wet locations shall be installed so as to prevent moisture or water from entering and accumulating within the enclosures and shall be mounted so there is at least 0.25 in. (6.35 mm) airspace between the enclosure and the wall or other supporting surface.

Exception: Nonmetallic enclosures may be installed without the airspace on a concrete, masonry, tile, or similar surface.

(b) Enclosures shall be weatherproof in wet locations.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2485.2. Switches, Circuit Breakers, and Switchboards.

Switches, circuit breakers, and switchboards installed in wet locations shall be enclosed in weatherproof enclosures.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 49. Flexible Cords and Cables

§2500.7. Uses Permitted.

(a) Flexible cords and cables shall be approved for conditions of use and location.

(b) ~~(a)~~ Flexible cords and cables shall be used only for:

- (1) pendants;
- (2) wiring of fixtures;
- (3) connection of portable lamps or appliances;
- (4) portable and mobile signs;
- (5) ~~(4)~~ elevator cables;
- (6) ~~(5)~~ wiring of cranes and hoists;
- (7) ~~(6)~~ connection of stationary equipment to facilitate their frequent interchange; ~~or~~
- (8) ~~(7)~~ prevention of the transmission of noise or vibration; ~~or~~
- (9) ~~(8)~~ ~~fixed or stationary~~ appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair; ~~or~~
- (10) ~~(9)~~ data processing cables as ~~permitted by Section 2565.2.~~ a part of the data processing system;
- (11) connection of moving parts; and
- (12) temporary wiring as permitted in Article 13 of these Low-Voltage Electrical Safety Orders.

(b) Where used as permitted in subsections (a)(3), (a)(7)(6), and (a)(9)(8) above, each flexible cord shall be equipped with an attachment plug and shall be energized from an approved receptacle outlet.

~~(Title 24, Part 3, Section 400-7.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2500.8. Uses Not Permitted.

(a) Unless specifically permitted otherwise in Section 2500.7, ~~f~~Flexible cords and cables shall not be used:

- (1) as a substitute for the fixed wiring of a structure;
- (2) where run through holes in walls, ceilings, or floors;
- (3) where run through doorways, windows or similar openings;
- (4) where attached to building surfaces; ~~or~~

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(5) where concealed behind building walls, ceilings, or floors; or

(6) Where installed in raceways, except as otherwise permitted in these Electrical Safety Orders.  
~~(Title 24, Part 3, Section 400-8.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and~~  
~~Section 18943(c), Health and Safety Code.~~

§2500.9. Splices.

(a) Flexible cords shall be used only in continuous lengths without splice or tap. Hard service flexible cords No. 12 or larger shall be permitted to be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and~~  
~~Section 18943(c), Health and Safety Code.~~

§2500.10. Pull at Joints and Terminals.

(a) Flexible cords and cables shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and~~  
~~Section 18943(c), Health and Safety Code.~~

§2500.11. In Show Windows and Show Cases.

Flexible cords used in show windows and show cases shall be Type S, SE, SEO, SEOO, SO, SJ,  
SJE, SJE0, SJE00, SJO, SJO0, SJT, SJTO, SJTO0, SO, SOO, ST, STO, or STOO, ~~or AFS~~

EXCEPTION: No. 1: For the wiring of chain-supported lighting fixtures.

EXCEPTION: No. 2: As supply cords for portable lamps and other merchandise being displayed or exhibited.

~~(Title 24, Part 3, Section 400-11.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and~~  
~~Section 18943(c), Health and Safety Code.~~

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§2500.23. ~~Grounding~~ Conductor Identification.

(a) A conductor of a flexible cord or cable that is used as a grounded conductor or an equipment grounding conductor intended to be used as a grounding conductor shall have a continuous identifying marker readily distinguishing it from the other conductor or conductors.

(1) Conductors having a continuous green color or a continuous green color with one or more yellow stripes shall not be used for other than grounding purposes. The identifying marker shall consist of one of the methods in (A) or (B) (a) or (b) below:

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(A) ~~(a)~~ Colored Braid. A braid finished to show a continuous green color or a continuous green color with one or more yellow stripes.

(B) ~~(b)~~ Colored Insulation or Covering. For cords having no braids on the individual conductors, an insulation of a continuous green color or a continuous green color with one or more yellow stripes.

(b) Types S, SC, SCE, SCT, SE, SEO, SEOO, SJ, SJE, SJE, SJEO, SJEOO, SJO, SJT, SJTO, SJTOO, SO, SOO, ST, STO, and STOO flexible cords and Types G, G-GC, PPE, and W flexible cables shall be durably marked on the surface at intervals not exceeding 24 in. (610 mm) with the type designation, size, and number of conductors.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 50. Fixture Wires

§2505.2. General.

Fixture wires shall be approved for the voltage, temperature, and location of use. A fixture wire which is used as a grounded conductor shall be identified.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2505.10. Uses Permitted.

Fixture wires shall be permitted only for:

(1) ~~for~~ installation in lighting fixtures and in similar equipment where enclosed or protected and not subject to bending or twisting in use; or

(2) ~~for~~ connecting lighting fixtures to the branch-circuit conductors supplying the fixtures.

~~(Title 24, Part 3, Section 402-10.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2505.11. Uses Not Permitted.

Fixture wires shall not be used as branch-circuit conductors.

EXCEPTION: As permitted for Class 1 power limited circuits and for fire alarm circuits.

~~(Title 24, Part 3, Section 402-11.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 51. Lighting Fixtures, Lampholders, Lamps and Receptacles

§2510.4. Live Parts.

Fixtures, lampholders, lamps, rosettes, and receptacles shall have no live parts normally exposed to contact.

~~(Title 24, Part 3, Section 3-410-3.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2510.5. Wet and Damp Locations.

Fixtures installed in wet or damp locations shall be approved for the purpose and shall be so constructed or installed that water cannot enter or accumulate in wireways, lampholders, or other electrical parts.

(a) A receptacle installed in a wet or damp location shall be suitable for the location.

(b) A receptacle installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure for the receptacle that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed).

NOTE: A receptacle is considered to be in a location protected from the weather when it is located under roofed open porches, canopies, marquees, or the like and where it will not be subjected to a beating rain or water runoff.

(c) A receptacle installed in a wet location where the product intended to be plugged into it is not attended while in use (for example, sprinkler system controllers, landscape lighting, and holiday lights) shall have an enclosure that is weatherproof with the attachment plug cap inserted or removed.

(d) A receptacle installed in a wet location where the product intended to be plugged into it will be attended while in use (for example, portable tools) shall have an enclosure that is weatherproof when the attachment plug cap is removed.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2510.6. Portable Handlamps.

Handlamps of the portable type supplied through flexible cords shall be equipped with a handle of molded composition or other material approved for the purpose, and a substantial guard shall be attached to the lampholder or the handle. Metal shell, paper-lined lampholders shall not be used.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.



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§2510.7. Receptacles.

(a) Grounding Type.

Receptacles shall be of the grounding type as prescribed by Article 6. ~~Unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment grounding conductor and all receptacles shall be electrically connected to the grounding conductor.~~

~~(Title 24, Part 3, Section 210-7.)~~

(b) Skirted Plugs.

Attachment plugs or other connectors supplying equipment at more than 300 volts shall be of the skirted type.

EXCEPTION: Plugs or connectors so designed that the arc will be confined within the body or case of the device shall be acceptable.

~~(Title 24, Part 3, Section 3-400-24(b).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2510.8. Lampholders of the screw-shell type shall be installed for use as lampholders only. Where supplied by a circuit having a grounded conductor, the grounded conductor shall be connected to the screw shell. Lampholders installed in wet or damp locations shall be of the weatherproof type.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2510.56. Receptacles, Cord Connectors and Attachment Plugs (Caps).

(a) Attachment Plugs. All new or replacement 15- and 20-ampere attachment plugs and connectors shall be constructed so of dead front construction such that there are no exposed current-carrying ~~metal~~ parts except the prongs, blades or pins. The cover for wire terminations shall be a part that is essential for the operation of an attachment plug or connector (dead-front construction). Attachment plugs shall be installed so that their prongs, blades, or pins are not energized unless inserted into an energized receptacle. No receptacles may be installed so as to require an energized attachment plug as its source of supply.

~~EXCEPTION: Attachment plugs with separate insulating discs secured in place shall be permitted when the assembly is maintained in a safe condition.~~

(b) Non-interchangeability. Receptacles, cord connectors and attachment plugs shall be constructed so that the receptacle or cord connectors will not accept an attachment plug with a different voltage or current rating than that for which the device is intended. ~~Nongrounding type receptacles and connectors shall not accept grounding type attachment plugs.~~

EXCEPTION: A 20-ampere T-slot receptacle or cord connector shall be permitted to accept a 15-ampere attachment plug of the same voltage rating.

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~~(Title 24, Part 3, Section 410-56(g).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2510.58. Non-Grounding-Type Receptacles, Adapters, Cord Connectors, and Attachment Plugs.

~~(a) Grounding Poles. Grounding type receptacles, cord connectors, and attachment plugs shall be provided with one fixed grounding pole in addition to the circuit poles.~~

~~(Title 24, Part 3, Section 410-58(a) without Exception.)~~

~~(b) Grounding Pole Connection. Grounding type receptacles, adapters, cord connectors, and attachment plugs shall be grounded.~~

~~EXCEPTION: Receptacles mounted on portable and vehicle mounted generators in accordance with Section 2395.6 or 2405.4(c).~~

~~(Title 24, Part 3, Section 210-7(b).)~~

~~(c) Grounding Terminal Use. A grounding terminal or grounding type device shall not be used for purposes other than grounding.~~

~~(Title 24, Part 3, Section 410-58(c).)~~

(a) Nongrounding-type receptacles and connectors shall not be used for grounding-type attachment plugs.

(b) (d) Adapters. Two-pole to three-pole adapters shall not be used. Adapters permitting change to different rated (amperes or volts) configurations shall not be used.

~~EXCEPTION: No. 1: 15-amp receptacles shall be permitted to supply 20-amp adapters.~~

~~EXCEPTION: No. 2: Where grounding is not a requirement by Article 11 of these Orders.~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 52. Appliances

GENERAL

§2522.2. Energized Parts.

(a) Appliances shall have no live energized parts normally exposed to contact.

EXCEPTION: Toasters, grills, or other appliances in which the current-carrying parts at high temperatures are necessarily exposed.

~~(Title 24, Part 3, Section 422-2.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

INSTALLATION OF APPLIANCES

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§2522.8. Flexible Cords. [Repeal]

~~(a) Heater Cords. All smoothing irons and portable electrically heated appliances that are rated at more than 50 watts and produce temperatures in excess of 121°C (250°F) on surfaces with which the cord is likely to be in contact shall be provided with approved heater cords.~~

~~(b) Other Heating Appliances. All other portable electrically heated appliances shall be connected with approved types of cord.~~

~~(c) Other Appliances. Flexible cord shall be permitted (1) for connection of portable appliances; (2) for connection of stationary appliances to facilitate their frequent interchange or to prevent the transmission of noise or vibration; or (3) to facilitate the removal or disconnection of fixed appliances for maintenance or repair.~~

~~(Title 24, Part 3, Section 422-8(a)-(c).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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CONTROL AND PROTECTION OF APPLIANCES

§2522.20. Disconnecting Means.

Each appliance shall have a means to disconnect it from all ungrounded conductors. If an appliance is supplied by more than one source, the disconnecting means shall be grouped and identified.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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GENERAL

§2530.4. In Sight From.

If specified that one equipment shall be "in sight from" another piece of equipment, one shall be visible and not more than 50 feet from the other.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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DISCONNECTING MEANS

§2530.102. In Sight from Controller Location.

An individual disconnecting means shall be provided for each controller. A disconnecting means shall be located in sight from the controller location.

EXCEPTION: A single disconnecting means may be located adjacent to a group of coordinated controllers mounted adjacent to each other on a multi-motor continuous process machine.

~~(Title 24, Part 3, Section 430-102.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2530.103. To Disconnect Both Motor and Controller.

The disconnecting means shall disconnect the motor and the controller from all ungrounded supply conductors and shall be so designed that no pole can be operated independently. The disconnecting means shall be permitted in the same enclosure with the controller. (See Section 2530.113 for equipment receiving energy from more than one source.)

~~(Title 24, Part 3, Section 430-103.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2530.104. To Be Indicating.

The disconnecting means shall plainly indicate whether it is in the "open" (off) or "closed" (on) position.

~~(Title 24, Part 3, Section 430-104.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2530.107. Readily Accessible.

~~One of the~~ disconnecting means shall be readily accessible. If more than one disconnect is provided for the same equipment, only one need be readily accessible.

~~(Title 24, Part 3, Section 430-107.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2530.112. Motors Served by Single Disconnecting Means.

(a) Each motor shall be provided with an individual disconnecting means.

EXCEPTION: A single disconnecting means shall be permitted to serve a group of motors under any one of the following conditions:

(1) Where a number of motors drive several parts of a single machine or piece of apparatus, such as metal ~~and~~ or woodworking machines, cranes, and hoists.

(2) Where a group of motors is in a single room within sight from the location of the disconnecting means.

(3) Where a group of motors is under the protection of one set of branch-circuit protective devices.

~~(Title 24, Part 3, Section 430-112 without condition (b) of the Exception.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2530.120. Motors, motor-control apparatus, and motor branch-circuit conductors shall be protected against overheating due to motor overloads or failure to start, and against short-circuits or ground faults. These provisions do not require overload protection that will stop a motor where a shutdown is likely to introduce additional or increased hazards, as in the case of fire pumps, or where continued operation of a motor is necessary for a safe shutdown of equipment or process and motor overload sensing devices are connected to a supervised alarm.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2530.121. Where live parts of motors or controllers operating at over 150 volts to ground are guarded against accidental contact only by location, and where adjustment or other attendance may be necessary during the operation of the apparatus, suitable insulating mats or platforms shall be provided so that the attendant cannot readily touch live parts unless standing on the mats or platforms.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 57. Transformers and Transformer Vaults (Including Secondary Ties)

§2533.1. Scope.

This Article covers the installation of all transformers.

EXCEPTION: No: 1: Current transformers.

EXCEPTION: No: 2: Dry-type transformers that constitute a component part of other apparatus and comply with the requirements for such apparatus.

EXCEPTION: No: 3: Transformers which are an integral part of an X-ray, high-frequency, or electrostatic-coating apparatus.

EXCEPTION: No: 4: Transformers for sign and outline lighting that comply with Article 73.

EXCEPTION: No: 5: Transformers for electric-discharge lighting that comply with Article 51.

EXCEPTION: No: 6: Transformers used for power limited fire protective signaling circuits.

EXCEPTION: No: 7: Transformers used with Class 2 and Class 3 circuits.

EXCEPTION: No: 8: Liquid-filled or dry-type transformers used for research, development, or testing, where effective arrangements are provided to safeguard unqualified persons from contacting high-voltage terminals or energized conductors.

This Article also covers the installation of transformers in hazardous locations as modified by Article 59.

~~(Title 24, Part 3, Section 450-1.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 58. Capacitors

§2534.6. Drainage of Stored Charge.

Capacitors shall be provided with an automatic means of draining the stored charge after the capacitor is disconnected from its source of supply.

(a) Time of Discharge. The residual voltage of a capacitor shall be reduced to 50 volts or less within one minute after the capacitor is disconnected from the source of supply.

(b) Means of Discharge. The discharge circuit shall be either permanently connected to the terminals of the capacitor or capacitor bank, or provided with automatic means of connecting it to the terminals of the capacitor bank on removal of voltage from the line. Manual means of switching or connecting the discharge circuit shall not be used.

~~(Title 24, Part 3, Section 460-6.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2534.8. Disconnecting Means.

(a) A disconnecting means shall be provided in each ungrounded conductor for each capacitor bank.

EXCEPTION: Where a capacitor is connected on the load side of a motor-running overcurrent device.

(b) The disconnecting means shall not be required to open all ungrounded conductors simultaneously.

(c) The disconnecting means shall be permitted to disconnect the capacitor from the line as a regular operating procedure.

(d) The rating of the disconnecting means shall not be less than 135 percent of the rated current of the capacitor.

~~(Title 4, Part 3, Section 460-8.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~



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Article 58.1 Storage Batteries

§2535.1. Storage Batteries. Provisions shall be made for sufficient diffusion and ventilation of gases from storage batteries to prevent the accumulation of explosive mixtures. See General Industry Safety Orders, Section 5185 for additional requirements.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 59. Hazardous (Classified) Locations

§2540.1. Scope.

(a) Applicability. This Article covers the requirements for electric equipment and wiring for all voltages in locations ~~that which~~ are classified depending on the properties of the flammable vapors, liquids or gases, or combustible dusts or fibers which may be present therein and the likelihood that a flammable or combustible concentration or quantity is present. Hazardous (classified) locations may be found in occupancies such as, but not limited to, the following: Aircraft hangers, gasoline dispensing and service stations, bulk storage plants for gasoline or other volatile flammable liquids, paint-finishing process plants, health care facilities, agricultural or other facilities where excessive combustible dusts may be present, marinas, boat yards, and petroleum and chemical processing plants. Each room, section or area shall be considered individually in determining its classification.

(1) These hazardous (classified) locations are assigned the following ~~six~~ designations as follows:

Class I, Division 1

Class I, Division 2

Class I, Zone 0

Class I, Zone 1

Class I, Zone 2

Class II, Division 1

Class II, Division 2

Class III, Division 1

Class III, Division 2

~~(Title 24, Part 3, Section 3-500-1(a).)~~

(b) Classifications.

(1) (a) Class I Locations. Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations include ~~the those specified in (1) and (2)~~ following:

(A) (1) Class I, Division 1. A Class I, Division 1 location is a location:

1. (A) In which ignitable hazardous concentrations of flammable gases or vapors may exist continuously, intermittently, or periodically under normal operating conditions; or

2. (B) In which ignitable hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or

3. (C) In which breakdown or faulty operation of equipment or processes might release ignitable hazardous concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

NOTE: This classification usually includes locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another, interiors of spray booths

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and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; locations containing fat and oil extraction equipment using volatile flammable solvents; portions of cleaning and dyeing plants where flammable ~~hazardous~~ liquids are used; gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; the interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers; and all other locations where ignitable ~~hazardous~~ concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

(B) (2) Class I, Division 2. A Class I, Division 2 location is a location:

1. (A) In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in the event ~~in case~~ of accidental rupture or breakdown of such containers or systems, or as a result ~~in case~~ of abnormal operation of equipment; or

2. (B) in which ignitable ~~hazardous~~ concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or

3. (C) that is adjacent to a Class I, Division 1 location, and to which ignitable ~~hazardous~~ concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

NOTE: This classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used, but which would become hazardous only in case of an accident or of some unusual operating condition. The quantity of flammable ~~hazardous~~ materials that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that merit consideration in determining the classification and extent of each location. Piping without valves, checks, meters, and similar devices would not ordinarily introduce a hazardous condition even though used for flammable ~~hazardous~~ liquids or gases. Locations used for the storage of flammable ~~hazardous~~ liquids or of liquefied or compressed gases in sealed containers would not normally be considered hazardous unless also subject to other hazardous conditions ~~also~~.

Electrical conduits and their associated enclosures separated from process fluids by a single seal or barrier are classed as a Division 2 location if the outside of the conduit and enclosures is a non-hazardous location.

~~(Title 24, Part 3, Section 500-4.)~~

(C) Class I, Zone 0. A Class I, Zone 0 location is a location in which one of the following conditions exists:

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1. Ignitable concentrations of flammable gases or vapors are present continuously; or
  2. Ignitable concentrations of flammable gases or vapors are present for long periods of time.
- NOTE: As a guide in determining when flammable gases or vapors are present continuously or for long periods of time, refer to Recommended Practice for Classification of Locations for Electrical Installations of Petroleum Facilities Classified as Class I, Zone 0, Zone 1 or Zone 2, API RP 505-1997; Electrical Apparatus for Explosive Gas Atmospheres, Classifications of Hazardous Areas, IEC 79-10-1995; Area Classification Code for Petroleum Installations, Model Code--Part 15, Institute for Petroleum; and Electrical Apparatus for Explosive Gas Atmospheres, Classifications of Hazardous (Classified) Locations, ISA S12.24.01-1997.
- (D) Class I, Zone 1. A Class I, Zone 1 location is a location in which one of the following conditions exists:
1. Ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions; or
  2. Ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or
  3. Equipment is operated or processes are carried on of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electric equipment in a manner that would cause the electric equipment to become a source of ignition; or
  4. A location that is adjacent to a Class I, Zone 0 location from which ignitable concentrations of vapors could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.
- (E) Class I, Zone 2. A Class I, Zone 2 location is a location in which one of the following conditions exists:
1. Ignitable concentrations of flammable gases or vapors are not likely to occur in normal operation and if they do occur will exist only for a short period; or
  2. Volatile flammable liquids, flammable gases, or flammable vapors are handled, processed, or used, but in which the liquids, gases, or vapors are normally confined within closed containers or closed systems from which they can escape only as a result of accidental rupture or breakdown of the containers or system or as the result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used; or
  3. Ignitable concentrations of flammable gases or vapors normally are prevented by positive mechanical ventilation, but which may become hazardous as the result of failure or abnormal operation of the ventilation equipment; or
  4. A location that is adjacent to a Class I, Zone 1 location, from which ignitable concentrations of flammable gases or vapors could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

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(2) ~~(b)~~ Class II Locations. Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include ~~the those specified in (1) and (2)~~ following:

(A) ~~(4)~~ Class II, Division 1. A Class II, Division 1 location is a location:

1. ~~(A)~~ In which combustible dust is or may be in suspension in the air ~~continuously, intermittently, or periodically~~ under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures; or

2. ~~(B)~~ Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, through operation of protection devices, or from other causes; or

3. ~~(C)~~ In which combustible dusts of an electrically conductive nature may be present.

NOTE: This classification may include areas of grain handling and processing plants, starch plants, sugar-pulverizing plants, malting plants, hay-grinding plants, coal pulverizing plants, areas where metal dusts and powders are produced or processed, and other similar locations that contain dust producing machinery and equipment (except where the equipment is dust-tight or vented to the outside). These areas would have combustible dust in the air, under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures. usually includes the working areas of grain handling and storage plants; rooms containing grinders or pulverizers, cleaners, graders, scalpors, open conveyors or spouts, open bins or hoppers, mixers or blenders, automatic or hopper scales, packing machinery, elevator heads and boots, stock distributors, dust and stock collectors (except all-metal collectors vented to the outside), and all similar dust-producing machinery and equipment in grain processing plants, starch plants, sugar-pulverizing plants, malting plants, hay grinding plants, and other occupancies of similar nature; coal pulverizing plants (except where the pulverizing equipment is essentially dust tight); all working areas where metal dusts and powders are produced, processed, handled, packed, or stored (except in tight containers); and all other similar locations where combustible dust may, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Combustible dusts which are electrically nonconductive include dusts produced in the handling and processing of grain and grain products, pulverized sugar and cocoa, dried egg and milk powders, pulverized spices, starch and pastes, potato and wood flour, oil meal from beans and seed, dried hay, and other organic materials which may produce combustible dusts when processed or handled. ~~Electrically conductive nonmetallic dusts include dusts from pulverized coal, coke, carbon black, and charcoal.~~ Dusts containing magnesium or aluminum are particularly hazardous and the use of extreme ~~precaution is~~ will be necessary to avoid ignition and explosion.

(B) ~~(2)~~ Class II, Division 2. A Class II, Division 2 location is a location where: ~~in which~~ combustible dust will not normally be in suspension in the air or will not be likely to be thrown into suspension by the normal operation of equipment or apparatus in quantities sufficient to produce explosive or ignitable mixtures, but:

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~~(A) Where deposits or accumulations of such combustible dust may be sufficient to interfere with the safe dissipation of heat from electric equipment or apparatus; or~~

~~(B) Where such deposits or accumulations of combustible dust on, in, or in the vicinity of electric equipment might be ignited by arcs, sparks, or burning material from such equipment.~~

~~NOTE: Locations where dangerous concentrations of suspended dust would not be likely, but where dust accumulations might form on, or in the vicinity of electric equipment, would include rooms and areas containing only closed spouting and conveyors, closed bins or hoppers, or machines and equipment from which appreciable quantities of dust would escape only under abnormal operating conditions; rooms or areas adjacent to a Class II, Division 1 location as described in (1)(B) above, and into which explosive or ignitable concentrations of suspended dust might be communicated only under abnormal operating conditions; rooms or areas where the formation of explosive or ignitable concentrations of suspended dust is prevented by the operation of effective dust control equipment; warehouses and shipping rooms where dust-producing materials are stored or handled only in bags or containers; and other similar locations. (Title 24, Part 3, Section 500.5.)~~

1. Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations will normally be insufficient to interfere with the normal operation of electric equipment or other apparatus, but combustible dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment; and

2. Resulting combustible dust accumulations on, in, or in the vicinity of the electric equipment may be sufficient to interfere with the safe dissipation of heat from electric equipment or may be ignitable by abnormal operation or failure of electric equipment.

NOTE: This classification includes locations where dangerous concentrations of suspended dust would not be likely, but where dust accumulations might form on or in the vicinity of electric equipment. These areas may contain equipment from which appreciable quantities of dust would escape under abnormal operating conditions or be adjacent to a Class II Division 1 location, as described above, into which an explosive or ignitable concentration of dust may be put into suspension under abnormal operating conditions.

(3) (e) Class III Locations. Class III locations are those that are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include ~~the those specified in (1) and (2)~~ following:

(A) (4) Class III, Division 1. A Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.

NOTE: Such locations usually include some parts of rayon, cotton, and other textile mills; combustible fiber manufacturing and processing plants; cotton gins and cotton-seed mills; flax-processing plants; clothing manufacturing plants; woodworking plants, and establishments and industries involving similar hazardous processes or conditions.

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Easily ignitable fibers and flyings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, and other materials of similar nature.

(B) (2) Class III, Division 2. A Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, other than in the process of manufacture.

~~EXCEPTION: In process of manufacture.~~

~~(Title 24, Part 3, Section 500-6)~~

(c) Other sections of these Safety Orders. All applicable requirements in these Safety Orders apply to hazardous (classified) locations unless modified by provisions of this Article.

(d) Division and zone classification. In Class I locations, an installation must be classified as using the division classification system meeting Sections 2540.3 and 2540.4 of this Article or using the zone classification system meeting Section 2540.11. In Class II and Class III locations, an installation must be classified using the division classification system meeting Sections 2540.3 and 2540.4.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2540.2. General.

(a) Documentation. All areas designated as hazardous (classified) locations under the Class and Zone system and areas designated under the Class and Division system established after [the effective date of this standard] shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electric equipment at the location. Approval. Equipment shall be approved not only for the class of location but also for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present.

~~(Title 24, Part 3, Section 3-500-2(a).)~~

(b) Intrinsically safe equipment. Equipment and associated wiring approved as intrinsically safe shall be permitted in any hazardous (classified) location for which it is approved. Intrinsically safe equipment and wiring shall not be capable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration. Abnormal conditions shall include accidental damage to any field-installed wiring, failure of electrical components, application of over-voltage, adjustment and maintenance operations, and other similar conditions.

~~(Title 24, Part 3, Section 3-500-1(b).)~~

(c) Conduits. All metallic conduits shall be threaded and shall be made wrench-tight. Where it is impractical to make a threaded joint tight, a bonding jumper shall be utilized.

~~(Title 24, Part 3, Section 3-500-1(b).)~~

(d) Marking. Approved equipment not covered in paragraphs (d)(1) through (d)(3) of this section shall be marked to show the class, group, and operating temperature or temperature range based

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on operation in a 40 degrees C ambient, for which it is approved. The temperature marking shall not exceed the ignition temperature of the specific gas or vapor to be encountered.

~~(1) Equipment of the non heat producing type, such as junction boxes, conduit, and fittings and equipment of the heat production type having a maximum temperature not more than 100 degrees C (212 degrees F), shall not be required to have a marked operating temperature or temperature range.~~

~~(2) Fixed lighting fixtures marked for use in Class I, Division 2 locations only, need not be marked to indicate the group.~~

~~(3) Fixed general purpose equipment. Other than fixed lighting fixtures, which is acceptable for use in Division 2 locations shall not be required to be marked with the class, group, division, or operating temperature.~~

~~(Title 24, Part 3, Section 500-2(b).)~~

~~(e) Equipment in Division 2 Locations. Equipment that has been approved for a Division 1 location shall be permitted in a Division 2 location of the same class and group. General purpose equipment or equipment in general purpose enclosures shall be permitted to be installed in Division 2 locations if the equipment does not constitute a source of ignition under normal operating conditions.~~

~~(Title 24, Part 3, Section 500-2(a).)~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

§2540.3. Electrical Installations.

(a) Equipment, wiring methods and installations of equipment in hazardous (classified) locations shall be one or more of the following:

(1) ~~(a)~~ Intrinsically safe.

(2) ~~(b)~~ Approved for the hazardous (classified) location.

(e) Of a type and design which provides protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts or fibers.

(3) Safe for the hazardous (classified) location.

(b) Requirements for each of these options are as follows:

(1) Intrinsically safe equipment. Equipment and associated wiring approved as intrinsically safe shall be permitted in any hazardous (classified) location for which it is approved.

(2) Approved for the hazardous (classified) location.

(A) Equipment shall be approved not only for the class of location, but also for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present.

NOTE: NFPA 70, the National Electrical Code, lists or defines hazardous gases, vapors, and dusts by "Groups" characterized by their ignitable or combustible properties.

(B) Equipment shall be marked to show the class, group, and operating temperature or temperature range, based on operation in a 40-degree C ambient, for which it is approved. The



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temperature marking may not exceed the ignition temperature of the specific gas or vapor to be encountered. However, the following provisions modify this marking requirement for specific equipment:

1. Equipment of the nonheat-producing type, such as junction boxes, conduit, and fittings, and equipment of the heat-producing type having a maximum temperature not more than 100 degrees C (212 degrees F) need not have a marked operating temperature or temperature range.

2. Fixed lighting fixtures marked for use in Class I, Division 2 or Class II, Division 2 locations only need not be marked to indicate the group.

3. Fixed general-purpose equipment in Class I locations, other than lighting fixtures, that is acceptable for use in Class I, Division 2 locations need not be marked with the class, group, division, or operating temperature.

4. Fixed dust-tight equipment, other than lighting fixtures, that is acceptable for use in Class II, Division 2 and Class III locations need not be marked with the class, group, division, or operating temperature.

5. Electric equipment suitable for ambient temperatures exceeding 40 degrees C (104 degrees F) shall be marked with both the maximum ambient temperature and the operating temperature or temperature range at that ambient temperature.

(3) Safe for the hazardous (classified) location. Equipment that is safe for the location shall be of a type and design that the employer demonstrates will provide protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts, or fibers involved.

NOTE: The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installations that will meet this requirement. Those guidelines address electric wiring, equipment, and systems installed in hazardous (classified) locations and contain specific provisions for the following: wiring methods, wiring connections; conductor insulation, flexible cords, sealing and drainage, transformers, capacitors, switches, circuit breakers, fuses, motor controllers, receptacles, attachment plugs, meters, relays, instruments, resistors, generators, motors, lighting fixtures, storage battery charging equipment, electric cranes, electric hoists and similar equipment, utilization equipment, signaling systems, alarm systems, remote control systems, local loud speaker and communication systems, ventilation piping, live parts, lightning surge protection, and grounding.

(c) Conduits. All conduits shall be threaded and shall be made wrench-tight. Where it is impractical to make a threaded joint tight, a bonding jumper shall be utilized.

(d) Equipment in Division 2 Locations. Equipment that has been approved for a Division 1 location may be installed in a Division 2 location of the same class and group. General-purpose equipment or equipment in general-purpose enclosures may be installed in Division 2 locations if the employer can demonstrate that the equipment does not constitute a source of ignition under normal operating conditions.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2540.4. Protection Techniques. Special Precautions.

~~Installation and use of equipment shall comply with the applicable provisions of Title 24, Part 3.~~

~~NOTE: Guidelines for Equipment and Installations. The National Electrical Code, 1984 Edition, contains guidelines that are appropriate for determining the type and design of equipment and installations with respect to paragraph (c) of Section 2540.3. The guidelines of this referenced document address electrical wiring, equipment, and systems installed in hazardous (classified) locations and contain specific provisions for the following: wiring methods, wiring connections, conductor insulation, flexible cords, sealing and drainage, transformers, capacitors, switches, circuit breakers, fuses, motor controllers, receptacles, attachment plugs, meters, relays, instruments, resistors, generators, motors, lighting fixtures, storage battery charging equipment, electric cranes, electric hoists and similar equipment, utilization equipment, signaling systems, alarm systems, remote control systems, local loud speaker and communication systems, ventilation piping, live parts, lightning surge protection, and grounding.~~

(a) The following are acceptable protection techniques for electric and electronic equipment in hazardous (classified) locations.

(1) Explosion-proof apparatus. This protection technique is permitted for equipment in the Class I, Division 1 and 2 locations for which it is approved.

(2) Dust ignition-proof. This protection technique is permitted for equipment in the Class II, Division 1 and 2 locations for which it is approved.

(3) Dust-tight. This protection technique is permitted for equipment in the Class II, Division 2 and Class III locations for which it is approved.

(4) Purged and pressurized. This protection technique is permitted for equipment in any hazardous (classified) location for which it is approved.

(5) Nonincendive circuit. This protection technique is permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

(6) Nonincendive equipment. This protection technique is permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

(7) Nonincendive component. This protection technique is permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

(8) Oil immersion. This protection technique is permitted for current-interrupting contacts in Class I, Division 2 locations as described in these Orders.

(9) Hermetically sealed. This protection technique is permitted for equipment in Class I, Division 2; Class II, Division 2; and Class III, Division 1 or 2 locations.

(10) Other protection techniques. Any other protection technique that meets Section 2540.3 of these Orders is acceptable in any hazardous (classified) location.

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

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§2540.11. Class I, Zone 0, 1, and 2 Locations.

(a) Scope. Employers may use the zone classification system as an alternative to the division classification system for electric and electronic equipment and wiring for all voltages in Class I, Zone 0, Zone 1, and Zone 2 hazardous (classified) locations where fire or explosion hazards may exist due to flammable gases, vapors, or liquids.

(b) Location and General Requirements.

(1) Locations shall be classified depending on the properties of the flammable vapors, liquids, or gases that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Where pyrophoric materials are the only materials used or handled, these locations need not be classified.

(2) Each room, section, or area shall be considered individually in determining its classification.

(c) Threading. All threaded conduit shall be threaded with an NPT [National (American) Standard Pipe Taper] standard conduit cutting die that provides 3/4-in. taper per foot. The conduit shall be made wrench tight to prevent sparking when fault current flows through the conduit system and to ensure the explosion-proof or flame-proof integrity of the conduit system where applicable.

Equipment provided with threaded entries for field wiring connection shall be installed in accordance with subsection (1) or (2) as follows:

(1) For equipment provided with threaded entries for NPT threaded conduit or fittings, listed conduit, conduit fittings, or cable fittings shall be used.

(2) For equipment with metric threaded entries, such entries shall be identified as being metric, or listed adaptors to permit connection to conduit of NPT-threaded fittings shall be provided with the equipment. Adapters shall be used for connection to conduit or NPT-threaded fittings.

(d) Protection Techniques. One or more of the following protection techniques shall be used for electric and electronic equipment in hazardous (classified) locations classified under the zone classification system.

(1) Flameproof “d.” This protection technique is permitted for equipment in the Class I, Zone 1 locations for which it is approved.

(2) Purged and pressurized. This protection technique is permitted for equipment in the Class I, Zone 1 or Zone 2 locations for which it is approved.

(3) Intrinsic safety. This protection technique is permitted for equipment in the Class I, Zone 0 or Zone 1 locations for which it is approved.

(4) Type of protection “n.” This protection technique is permitted for equipment in the Class I, Zone 2 locations for which it is approved. Type of protection “n” is further subdivided into nA, nC, and nR.

(5) Oil Immersion “o.” This protection technique is permitted for equipment in the Class I, Zone 1 locations for which it is approved.

(6) Increased safety “e.” This protection technique is permitted for equipment in the Class I, Zone 1 locations for which it is approved.

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(7) Encapsulation “m.” This protection technique is permitted for equipment in the Class I, Zone 1 locations for which it is approved.

(8) Powder Filling “q.” This protection technique is permitted for equipment in the Class I, Zone 1 locations for which it is approved.

(e) Special Precaution. This Article (Article 59) requires equipment construction and installation that will ensure safe performance under conditions of proper use and maintenance.

(1) Classification of areas and selection of equipment and wiring methods shall be under the supervision of a qualified registered professional engineer.

(2) In instances of areas within the same facility classified separately, Class I, Zone 2 locations may abut, but not overlap, Class I, Division 2 locations. Class I, Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations.

(3) A Class I, Division 1 or Division 2 location may be reclassified as a Class I, Zone 0, Zone 1, or Zone 2 location only if all of the space that is classified because of a single flammable gas or vapor source is reclassified.

NOTE to subsection (e): Low ambient conditions require special consideration. Electric equipment depending on the protection techniques described by subsection (d)(1) of this section may not be suitable for use at temperatures lower than -20 degrees C (-4 degrees F) unless they are approved for use at lower temperatures. However, at low ambient temperatures, flammable concentrations of vapors may not exist in a location classified Class I, Zone 0, 1, or 2 at normal ambient temperature.

(f) Listing and Marking.

(1) Equipment that is listed for a Zone 0 location may be installed in a Zone 1 or Zone 2 location of the same gas or vapor. Equipment that is listed for a Zone 1 location may be installed in a Zone 2 location of the same gas or vapor.

(2) Equipment shall be marked in accordance with subsections (f)(2)(A) or (f)(2)(B) as follows:

(A) Division equipment. Equipment approved for Class I, Division 1 or Class 1, Division 2 shall, in addition to being marked in accordance with Section 2540.3(b)(2)(B), be marked with the following:

1. Class I, Zone 1 or Class I, Zone 2 (as applicable);

2. Applicable gas classification groups; and

3. Temperature classification; or

(B) Zone equipment. Equipment meeting one or more of the protection techniques described in subsection (d) of this section shall be marked with the following in the order shown:

1. Class, except for intrinsically safe apparatus;

2. Zone, except for intrinsically safe apparatus;

3. Symbol “AEx;”

4. Protection techniques;

5. Applicable gas classification groups; and

6. Temperature classification, except for intrinsically safe apparatus.

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NOTE to subsection (f)(2)(B): An example of such a required marking is “Class I, Zone 0, AEx ia IIC T6.” See Figure S-1 for an explanation of this marking.

EXCEPTION to (f)(2): Equipment that the employer demonstrates will provide protection from the hazards arising from the flammability of the gas or vapor and the zone of location involved and will be recognized as providing such protection by employees need not be marked.

NOTE for EXCEPTION: The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installations that will meet this provision.

**Figure S-1—Example Marking for Class I, Zone 0, AEx ia IIC T6**

	Example:	Class I	Zone 0	AEx	ia	IIC	T6
Area classification	_____						
Symbol for equipment built to American specifications	_____						
Type of protection designations	_____						
Gas classification group (as required)	_____						
Temperature classification	_____						

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 73. Electric Signs and Outline Lighting

**GENERAL**

**§2560.2. Disconnecting Means ~~Required~~.**

(a) Each sign and outline lighting system, or feeder circuit or branch circuit supplying a sign or outline lighting system, shall be controlled by an externally operable switch or circuit breaker that will open all ungrounded conductors.

EXCEPTIONS:

1. A disconnecting means is not required for an exit directional sign located within a building.

2. A disconnecting means is not required for cord-connected signs with an attachment plug.

(b) Each outline lighting installation, and each sign of other than the portable type, shall be controlled by an externally operable switch or breaker which will open all ungrounded conductors.

The disconnecting means shall be within sight of the sign or outline lighting which it controls.

EXCEPTION: Signs operated by electronic or electromechanical controllers located external to the sign shall have a disconnecting means located within sight from the controller location. The disconnecting means shall disconnect the sign and the controller from all ungrounded supply conductors and shall be so designed that no pole can be operated independently. The disconnecting means shall be permitted to be in the same enclosure with the controller. The disconnecting means shall be capable of being locked in the "open" position.

(c) For installations built on or after [effective date of these orders] signs and outline lighting systems located within fountains shall have the disconnect located at least 5.0 feet (1.52 m) from the inside walls of the fountain.

~~(Title 24, Part 3, Section 600-2(a).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

**§2560.3. Location.**

(a) The disconnecting means shall be within sight of the sign or outline lighting system that it controls. Where the disconnecting means is out of the line of sight from any section that may be energized, the disconnecting means shall be capable of being locked in the open position.

(b) Signs or outline lighting systems operated by electronic or electromechanical controllers located external to the sign or outline lighting system may have a disconnecting means located within sight of the controller or in the same enclosure with the controller. The disconnecting means shall disconnect the sign or outline lighting system and the controller from all ungrounded supply conductors. It shall be designed so no pole can be operated independently and shall be capable of being locked in the open position.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 74. Cranes and Hoists

§2561.1. Scope.

This Article applies to ~~cranes and hoists of rated capacity exceeding one (1) ton.~~ the installation of electric equipment and wiring used in connection with cranes, monorail hoists, hoists, and all runways.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2561.3. Clearance.

(a) On every new installation, major replacement, modification or repair made after March 15, 1972, the dimension of the working space in the direction of access to energized parts which may ~~are likely to~~ require examination, adjustment, servicing, or maintenance while energized shall ~~be in accordance with Section 2340.16 of these orders.~~ a minimum of 2.5 feet (762 mm). ~~Where controls are enclosed in cabinets, the doors shall either open at least 90 degrees or be removable.~~

NOTE: For the purpose of this section, a major replacement, modification, or repair shall mean 50 percent or more of the current replacement value of the crane or hoist.

~~On all installations made prior to March 15, 1972 which do not comply with the provisions of Section 2340.16, the employer shall provide control cabinets and enclosure doors which open at least 90 degrees or are removable.~~

(b) On floor operated overhead cranes a suitable work platform with means of access shall be provided, attached to the building structure, or on the overhead crane bridge, giving ready and safe access to electrical control cabinets for service, maintenance or repair.

EXCEPTION: Floor operated porta-lift type platforms, rolling scaffolds or similar type platforms may be used.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

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§2561.31. ~~Track and~~ Runway Conductor Disconnecting Means.

~~Suitable disconnecting means shall be readily accessible and operable from the ground, shall be arranged to be locked in the "open" position, shall open all ungrounded conductors simultaneously, and shall be placed within view of the track and runway contact conductors.~~

(a) A disconnecting means shall be provided between the runway contact conductors and the power supply. Such disconnecting means shall consist of a motor-circuit switch, circuit breaker, or molded case switch. The disconnecting means shall open all ungrounded conductors simultaneously and shall be:

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- (1) Readily accessible and operable from the ground or floor level;
- (2) Arranged to be locked in the open position; and
- (3) Placed within view of the runway contact conductors.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2561.32. Disconnecting Means for Cranes and Monorail Hoists.

~~A motor circuit switch or circuit breaker arranged to be locked in the "open" position shall be provided in the leads from the track and runway contact conductors or other power supply on all cranes and monorail hoists.~~

~~EXCEPTION: Where a monorail hoist, monorail crane or hand-propelled crane bridge installation meets all of the following, the disconnect may be omitted:~~

- ~~1. The unit is floor controlled.~~
- ~~2. The unit is within view of the power supply disconnecting means.~~
- ~~3. No fixed work platform has been provided for servicing the unit.~~

~~Where the disconnecting means is not readily accessible from the crane or monorail operating station, means shall be provided at the operating station to open the power to all motors of the crane or monorail hoist.~~

(a) A motor-circuit switch, molded case switch, or circuit breaker shall be provided in the leads from the runway contact conductors or other power supply on all cranes and monorail hoists.

EXCEPTION: The disconnecting means may be omitted where a monorail hoist or hand-propelled crane bridge installation meets all of the following conditions:

- (1) The unit is controlled from the ground or floor level;
- (2) The unit is within view of the power supply disconnecting means; and
- (3) No fixed work platform has been provided for servicing the unit.

(b) The disconnecting means shall be capable of being locked in the open position.

(c) Means shall be provided at the operating station to open the power circuit to all motors of the crane or monorail hoist where the disconnecting means is not readily accessible from the crane or monorail hoist operating station.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2561.50. Controls. [Repeal].

~~(a) Cranes or hoists not equipped with spring return controls or momentary contact pushbuttons, shall be provided with a device which will disconnect all motors from the line on failure of line power and will not permit any motor to be restarted on line power until the control handle is brought to the "off" position, or a reset switch or button is operated.~~

~~(b) Crane or hoist controls that are rope or line actuated, shall automatically return to the "off" position when released by the operator.~~



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~~(c) Lever-operated controls shall be provided with a mechanical device which will hold the handle in the "off" position, requiring voluntary effort to move it from the "off" position to the "on" position.~~

~~(d) All manually operated controls shall be plainly marked to indicate their function and the equipment they control. As far as is practicable, the movement of each control handle shall be in the same general direction as the resultant movement of the load.~~

~~(e) Control handles shall be located within convenient reach of the operator.~~

~~(f) Controls for the bridge and trolley shall be so located that the operator can readily see the direction of travel while operating the controls.~~

~~(g) All electric cranes of similar design operating in a given plant shall be so wired that like motion of control handles will produce like effect in similarly controlled mechanisms.~~

~~(h) Automatic or remote-operated cranes shall function so that if the control signal for any crane motion becomes ineffective, crane motion will stop.~~

~~(i) Pendant control shall return to the "off" position when released by the operator.~~

~~NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.~~

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Subchapter 5. Electrical Safety Orders  
Group 1. Low-Voltage Electrical Safety Orders  
Article 74.1. Elevators, Dumbwaiters, Escalators, Moving Walks, Wheelchair Lifts, and  
Stairway Chair Lifts

§2562.1. Scope. The following requirements apply to elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chair lifts.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2562.2. Disconnecting Means. Elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chair lifts shall have a single means for disconnecting all ungrounded main power supply conductors for each unit.

(a) Control Panels. Control panels not located in the same space as the drive machine shall be located in cabinets with doors or panels capable of being locked closed.

(b) Type. The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position. The disconnecting means shall be a listed device.

(c) Operation. For installations built on or after [effective date of these orders] no provision may be made to open or close this disconnecting means from any other part of the premises. If sprinklers are installed in hoistways, machine rooms, or machinery spaces, the disconnecting means may automatically open the power supply to the affected elevators prior to the application of water. No provision may be made to close this disconnecting means automatically (that is, power may only be restored by manual means).

(d) Location. For installations built on or after [effective date of these orders] the disconnecting means shall be located where it is readily accessible to qualified persons.

(1) Elevators Without Generator Field Control. On elevators without generator field control, the disconnecting means shall be located within sight of the motor controller. Driving machines or motion and operation controllers not within sight of the disconnecting means shall be provided with a manually operated switch installed in the control circuit adjacent to the equipment in order to prevent starting. Where the driving machine is located in a remote machinery space, a single disconnecting means for disconnecting all ungrounded main power supply conductors shall be provided and be capable of being locked in the open position.

(2) Elevators With Generator Field Control. On elevators with generator field control, the disconnecting means shall be located within sight of the motor controller for the driving motor of the motor-generator set. Driving machines, motor-generator sets, or motion and operation controllers not within sight of the disconnecting means shall be provided with a manually operated switch installed in the control circuit to prevent starting. The manually operated switch shall be installed adjacent to this equipment. Where the driving machine or the motor-generator

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set is located in a remote machinery space, a single means for disconnecting all ungrounded main power supply conductors shall be provided and be capable of being locked in the open position.

(3) Escalators And Moving Walks. On escalators and moving walks, the disconnecting means shall be installed in the space where the controller is located.

(4) Wheelchair Lifts And Stairway Chair Lifts. On wheelchair lifts and stairway chair lifts, the disconnecting means shall be located within sight of the motor controller.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2562.3. Identification and Signs.

For installations built on or after [effective date of these orders]:

(a) Where there is more than one driving machine in a machine room, the disconnecting means shall be numbered to correspond to the identifying number of the driving machine that they control.

(b) The disconnecting means shall be provided with a sign to identify the location of the supply-side overcurrent protective device.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2562.4. Single-Car and Multicar Installations. For installations built on or after [effective date of these orders] on single-car and multicar installations, equipment receiving electrical power from more than one source shall be provided with a disconnecting means for each source of electrical power. The disconnecting means shall be within sight of the equipment served.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2562.5. Warning sign for Multiple Disconnecting Means. A warning sign shall be mounted on or next to the disconnecting means where multiple disconnecting means are used and parts of the controllers remain energized from a source other than the one disconnected. The sign shall be clearly legible and shall read: "WARNING--PARTS OF THE CONTROLLER ARE NOT DEENERGIZED BY THIS SWITCH."

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2562.6. Interconnection Between Multicar Controllers. A warning sign worded as required in Section 2562.5 shall be mounted on or next to the disconnecting means where interconnections between controllers are necessary for the operation of the system on multicar installations that remain energized from a source other than the one disconnected.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2562.7. Motor Controllers. Motor controllers may be located outside the spaces otherwise required by this Article, provided they are in enclosures with doors or removable panels capable of being locked closed and the disconnecting means is located adjacent to or is an integral part of the motor controller. Motor controller enclosures for escalators or moving walks may be located in the balustrade on the side located away from the moving steps or moving treadway. If the disconnecting means is an integral part of the motor controller, it shall be operable without opening the enclosure.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 75. Electric Welders

§2563.23. Disconnecting Means--Arc Welders.

(a) A disconnecting means shall be provided in the supply circuit for each ~~motor-generator arc welder and for each AC transformer and DC rectifier arc welder which~~ that is not equipped with a disconnect mounted as an integral part of the welder. The disconnecting means shall be a switch or circuit breaker, and its rating shall not be less than that necessary to accommodate overcurrent protection.

~~(Title 24, Part 3, Section 3-630-23.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

§2563.33. Disconnecting Means--Resistance Welders.

(a) A switch or circuit breaker shall be provided by which each resistance welder and its control equipment can be disconnected ~~isolated~~ from the supply circuit. The ampere rating of this disconnecting means may not be less than the supply conductor ampacity. The supply circuit switch may be used as the welder disconnecting means where the circuit supplies only one welder.

~~(Title 24, Part 3, Section 630-33.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 77. Information Technology Equipment ~~Data Processing Systems~~

§2565.3. Disconnecting Means.

(a) A disconnecting means shall be provided to disconnect the power to all electronic equipment in an information technology equipment room ~~data processing or computer rooms~~. ~~This disconnecting means shall be controlled from locations readily accessible to the operator at the principal exit doors.~~ There shall also be a similar ~~disconnecting~~ means to disconnect the power to all dedicated heating, ventilating and air conditioning (HVAC) systems serving the room and to cause all required fire/smoke dampers to close this area.

EXCEPTION: Integrated electrical systems covered by Article 89 need not have the disconnecting means required by this section.

~~(Title 24, Part 3, Section 645 3.)~~

(b) Grouping. The control for these disconnecting means shall be grouped and identified and shall be readily accessible at the principal exit doors. A single means to control both the electronic equipment and HVAC system is permitted.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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Article 77.1. X-Ray Equipment

§2566.1. Scope. This Article applies to X-ray equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2566.2. Disconnecting Means.

(a) A disconnecting means shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the X-ray control. For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug cap and receptacle of proper rating may serve as a disconnecting means.

(b) If more than one piece of equipment is operated from the same high-voltage circuit, each piece or each group of equipment as a unit shall be provided with a high-voltage switch or equivalent disconnecting means. The disconnecting means shall be constructed, enclosed, or located so as to avoid contact by employees with its live parts.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2566.3 Control. The following requirements apply to industrial and commercial laboratory equipment.

(a) Radiographic and fluoroscopic-type equipment shall be effectively enclosed or shall have interlocks that deenergize the equipment automatically to prevent ready access to live current-carrying parts.

(b) Diffraction- and irradiation-type equipment shall have a pilot light, readable meter deflection, or equivalent means to indicate when the equipment is energized, unless the equipment or installation is effectively enclosed or is provided with interlocks to prevent access to live current-carrying parts during operation.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 77.2. Induction and Dielectric Heating Equipment

§2567.1. Scope. This Article applies to induction and dielectric heating equipment and accessories for industrial and scientific applications, but not for medical or dental applications or for appliances.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2567.2. Guarding and Grounding.

(a) The converting apparatus (including the dc line) and high-frequency electric circuits (excluding the output circuits and remote-control circuits) shall be completely contained within enclosures of noncombustible material.

(b) All panel controls shall be of dead-front construction.

(c) Doors or detachable panels shall be employed for internal access. Where doors are used giving access to voltages from 500 to 600 volts ac or dc, either door locks shall be provided or interlocks shall be installed. Detachable panels not normally used for access to such parts shall be fastened in a manner that will make them difficult to remove (for example, by requiring the use of tools).

(d) Warning labels or signs that read "DANGER--HIGH VOLTAGE--KEEP OUT" shall be attached to the equipment and shall be plainly visible where persons might contact energized parts when doors are opened or closed or when panels are removed from compartments containing over 250 volts ac or dc.

(e) Induction and dielectric heating equipment shall be protected as follows:

(1) Protective cages or adequate shielding shall be used to guard work applicators other than induction heating coils.

(2) Induction heating coils shall be protected by insulation or refractory materials or both.

(3) Interlock switches shall be used on all hinged access doors, sliding panels, or other such means of access to the applicator, unless the applicator is an induction heating coil at dc ground potential or operating at less than 150 volts ac.

(4) Interlock switches shall be connected in such a manner as to remove all power from the applicator when any one of the access doors or panels is open.

(f) A readily accessible disconnecting means shall be provided by which each heating equipment can be isolated from its supply circuit. The ampere rating of this disconnecting means shall not be less than the nameplate current rating of the equipment. The supply circuit disconnecting means is permitted as a heating equipment disconnecting means where the circuit supplies only one piece of equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.



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§2567.3. Remote Control.

(a) If remote controls are used for applying power, a selector switch shall be provided and interlocked to provide power from only one control point at a time.

(b) Switches operated by foot pressure shall be provided with a shield over the contact button to avoid accidental closing of the switch.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 78. Electrically Driven or Controlled Irrigation Machines

GENERAL

§2568.8. Disconnecting Means.

(a) The main disconnecting means for a center pivot irrigation machine shall be located at the point of connection of electrical power to the machine or shall be visible and not more than 50 feet (15.2 m) from the machine.

(b) The disconnecting means ~~and~~ shall be readily accessible and capable of being locked in the open position.

(c) A disconnecting means shall be provided for each motor and controller.

~~(Title 24, Part 3, Section 675 8(b), (c).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

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§2568.15. Lightning Protection.

If an ~~electrically driven or controlled~~ irrigation machine has a stationary point, ~~a driven ground rod shall be connected to the machine at the stationary point for lightning protection.~~ a grounding electrode system shall be connected to the machine at the stationary point for lightning protection.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(e), Health and Safety Code.~~

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Article 79. Swimming Pools, Fountains and Similar Installations

GENERAL

**§2569.1. Scope.**

The provisions of this Article apply to electric wiring for and equipment in or adjacent to all swimming, wading, therapeutic, and decorative pools and fountains, and hydro-massage bathtubs, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment. Therapeutic pools in health care facilities are exempt from these provisions.

~~(Title 24, Part 3, Section 680-1.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

**§2569.5. Receptacles.**

(a) Receptacles. A single receptacle of the locking and grounding type that provides power for a permanently installed swimming pool recirculating pump motor may be located not less than 5 feet (1.52 m) from the inside walls of a pool. All other receptacles on the property shall be located at least 10 feet (3.05 m) from the inside walls of a pool.

(b) Receptacles which are located within 15 feet (4.57 m) or 20 feet (6.08 m) if the installation was built after [effective date of this standard], of the inside walls of the pool shall be protected by ground-fault circuit interrupters.

(c) For installations built on or after [effective date of these orders] where a pool is installed permanently at a dwelling unit, at least one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit shall be located a minimum of 10 feet (3.05 m) and not more than 20 feet (6.08 m) from the inside wall of the pool. This receptacle shall be located not more than 6.5 feet (1.98 m) above the floor, platform, or grade level serving the pool.

NOTE: In determining these dimensions, the distance to be measured is the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, or ceiling of a building or other effective permanent barrier.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

**§2569.6. ~~Receptacles and~~ Lighting Fixtures, Lighting Outlets, and Ceiling Suspended (Paddle) Fans.**

~~(a) Receptacles. A single receptacle of the locking and grounding type that provides power for a permanently installed swimming pool recirculating pump motor may be located not less than 5~~

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feet from the inside walls of a pool. All other receptacles on the property shall be located at least 10 feet from the inside walls of a pool. Receptacles which are located within 15 feet of the inside walls of the pool shall be protected by ground fault circuit interrupters.

NOTE: In determining these dimensions, the distance to be measured is the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, or ceiling of a building or other effective permanent barrier.

**(b) Lighting Fixtures and Lighting Outlets.**

(1) Unless they are 12 feet above the maximum water level, lighting fixtures and lighting outlets may not be installed over a pool or over the area extending 5 feet horizontally from the inside walls of a pool. However, a lighting fixture or lighting outlet which has been installed before April 16, 1981 may be located less than 5 feet measured horizontally from the inside walls of a pool if it is at least 5 feet above the surface of the maximum water level and shall be rigidly attached to the existing structure. It shall also be protected by a ground fault circuit interrupter installed in the branch circuit supplying the fixture.

(2) Unless installed 5 feet above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool, lighting fixtures and lighting outlets installed in the area extending between 5 feet and 10 feet horizontally from the inside walls of a pool shall be protected by a ground fault circuit interrupter.

(Title 24, Part 3, Section 680-6.)

(a) In outdoor pool areas, lighting fixtures, lighting outlets, and ceiling-suspended (paddle) fans may not be installed over the pool or over the area extending 5 feet (1.52 m) horizontally from the inside walls of a pool unless no part of the lighting fixture of a ceiling-suspended (paddle) fan is less than 12 feet (3.66 m) above the maximum water level. However, a lighting fixture or lighting outlet that was installed before April 16, 1981, may be located less than 5 feet (1.52 m) measured horizontally from the inside walls of a pool if it is at least 5 feet (1.52 m) above the surface of the maximum water level and is rigidly attached to the existing structure. It shall also be protected by a ground-fault circuit interrupter installed in the branch circuit supplying the fixture.

(b) Lighting fixtures and lighting outlets installed in the area extending between 5 feet (1.52 m) and 10 feet (3.05 m) horizontally from the inside walls of a pool shall be protected by a ground-fault circuit interrupter unless installed 5 feet (1.52 m) above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 18943(c), Health and Safety Code.

**§2569.7. Cord- and Plug-Connected Equipment.**

(a) Flexible cords used with the following equipment may not exceed 3 feet (0.9 m) in length and shall have a copper equipment grounding conductor with a grounding-type attachment plug.

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(1) Cord- and plug-connected lighting fixtures installed within 16 feet (4.88 m) of the water surface of permanently installed pools.

(2) Other cord- and plug-connected, fixed or stationary equipment used with permanently installed pools.

~~(Title 24, Part 3, Section 680-7.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

PERMANENTLY INSTALLED POOLS

§2569.20. Underwater Equipment Lighting Fixtures.

(a) A ground-fault circuit interrupter shall be installed in the branch circuit supplying underwater fixtures operating at more than 15 volts. Equipment installed underwater shall be identified ~~approved~~ for the purpose.

(b) No underwater lighting fixtures may be installed for operation at over 150 volts between conductors.

(c) A lighting fixture facing upward shall have the lens adequately guarded to prevent contact by any person.

~~(Title 24, Part 3, Section 680-20.)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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FOUNTAINS

§2569.51. ~~Ground Fault Circuit Interrupters Required.~~ Fountains.

All electric equipment, including power supply cords, operating at more than 15 volts, ~~including power supply cords,~~ and used with fountains shall be protected by ground-fault circuit interrupters.

~~(Title 24, Part 3, Section 680-51(a).)~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.-~~

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Article 80. Emergency Power Systems

§2571.1. Scope.

The provisions for emergency power systems apply to circuits, systems, and equipment intended to supply power for illumination and special loads, in the event of failure of the normal supply.  
(~~Title 24, Part 3, Section 700-1.~~)

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2571.9. Wiring methods. Emergency circuit wiring shall be kept entirely independent of all other wiring and equipment and may not enter the same raceway, cable, box, or cabinet or other wiring except either where common circuit elements suitable for the purpose are required, or for transferring power from the normal to the emergency source.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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§2571.16. Emergency Illumination.

(a) Emergency illumination shall include all required means of egress lighting, illuminated exit signs, and all other lights necessary to provide illumination.

(b) Where emergency lighting is necessary, the system shall be so arranged that the failure of any individual lighting element, such as the burning out of a light bulb, cannot leave any space in total darkness.

(~~Title 24, Part 3, Section 700-16.~~)

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; ~~and Section 18943(c), Health and Safety Code.~~

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§2571.30. Signs.

For installations built on or after [effective date of these orders]:

(a) A sign shall be placed at the service entrance equipment indicating the type and location of on-site emergency power sources. However, a sign is not required for individual unit equipment.

(b) Where the grounded circuit conductor connected to the emergency source is connected to a grounding electrode conductor at a location remote from the emergency source, there shall be a sign at the grounding location that shall identify all emergency and normal sources connected at that location.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 83. Electrolytic Cells

§2583.1. Scope. This Article applies to the installation of the electrical components and accessory equipment of electrolytic cells, electrolytic cell lines, and process power supply for the production of aluminum, cadmium, chlorine, copper, fluorine, hydrogen peroxide, magnesium, sodium, sodium chlorate, and zinc. Cells used as a source of electric energy and for electroplating processes and cells used for production of hydrogen are not covered by this Article.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.2. Application. Installations covered by this Article shall comply with all applicable provisions of these Safety Orders, except as follows:

- (a) Overcurrent protection of electrolytic cell dc process power circuits need not comply with the requirements of Article 10, Overcurrent Protection;
- (b) Equipment located or used within the cell line working zone or associated with the cell line dc power circuits need not comply with the provisions of Article 11, Grounding; and
- (c) Electrolytic cells, cell line conductors, cell line attachments, and the wiring of auxiliary equipment and devices within the cell line working zone need not comply with the provisions of Article 2, Administration, Article 6, Branch Circuits, or Article 8, Outdoor Wiring.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.3. Disconnecting Means. If more than one dc cell line process power supply serves the same cell line, a disconnecting means shall be provided on the cell line circuit side of each power supply to disconnect it from the cell line circuit. Removable links or removable conductors may be used as the disconnecting means.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.4. Portable Electric Equipment.

- (a) The frames and enclosures of portable electric equipment used within the cell line working zone may not be grounded, unless the cell line circuit voltage does not exceed 200 volts DC or the frames are guarded.

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(b) Ungrounded portable electric equipment shall be distinctively marked and shall employ plugs and receptacles of a configuration that prevents connection of this equipment to grounding receptacles and that prevents inadvertent interchange of ungrounded and grounded portable electric equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.5. Power Supply Circuits and Receptacles for Portable Electric Equipment.

(a) Circuits supplying power to ungrounded receptacles for hand-held, cord- and plug-connected equipment shall meet the following requirements:

(1) The circuits shall be electrically isolated from any distribution system supplying areas other than the cell line working zone and shall be ungrounded;

(2) The circuits shall be supplied through isolating transformers with primaries operating at not more than 600 volts between conductors and protected with proper overcurrent protection;

(3) The secondary voltage of the isolating transformers may not exceed 300 volts between conductors; and

(4) All circuits supplied from the secondaries shall be ungrounded and shall have an approved overcurrent device of proper rating in each conductor.

(b) Receptacles and their mating plugs for ungrounded equipment may not have provision for a grounding conductor and shall be of a configuration that prevents their use for equipment required to be grounded.

(c) Receptacles on circuits supplied by an isolating transformer with an ungrounded secondary:

(1) Shall have a distinctive configuration;

(2) Shall be distinctively marked; and

(3) Shall not be used in any other location in the facility.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.6. Fixed and Portable Electric Equipment.

(a) The following need not be grounded:

(1) AC systems supplying fixed and portable electric equipment within the cell line working zone; and

(2) Exposed conductive surfaces, such as electric equipment housings, cabinets, boxes, motors, raceways and the like that are within the cell line working zone.

(b) Auxiliary electric equipment, such as motors, transducers, sensors, control devices, and alarms, mounted on an electrolytic cell or other energized surface shall be connected to the premises wiring systems by any of the following means:

(1) Multiconductor hard usage or extra hard usage flexible cord;

(2) Wire or cable in suitable nonmetallic raceways or cable trays; or



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(3) Wire or cable in suitable metal raceways or metal cable trays installed with insulating breaks such that they will not cause a potentially hazardous electrical condition.

(c) Fixed electric equipment may be bonded to the energized conductive surfaces of the cell line, its attachments, or auxiliaries. If fixed electric equipment is mounted on an energized conductive surface, it shall be bonded to that surface.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.7. Auxiliary Nonelectrical Connections. Auxiliary nonelectrical connections such as air hoses, water hoses, and the like, to an electrolytic cell, its attachments, or auxiliary equipment may not have continuous conductive reinforcing wire, armor, braids, or the like.

Hoses shall be of a nonconductive material.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2583.8. Cranes and Hoists.

(a) The conductive surfaces of cranes and hoists that enter the cell line working zone need not be grounded. The portion of an overhead crane or hoist that contacts an energized electrolytic cell or energized attachments shall be insulated from ground.

(b) Remote crane or hoist controls that may introduce hazardous electrical conditions into the cell line working zone shall employ one or more of the following systems:

(1) Isolated and ungrounded control circuit;

(2) Nonconductive rope operator;

(3) Pendant pushbutton with nonconductive supporting means and with nonconductive surfaces or ungrounded exposed conductive surfaces; or

(4) Radio.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 84. Carnivals, Circuses, Fairs, and Similar Events

§2584.1 Scope. This Article covers the installation of portable wiring and equipment, including wiring in or on all structures, for carnivals, circuses, exhibitions, fairs, traveling attractions, and similar events installed on or after [effective date of these orders].

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.2. Protection of Electric Equipment. Electric equipment and wiring methods in or on rides, concessions, or other units shall be provided with mechanical protection where such equipment or wiring methods are subject to physical damage.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.3. Services.

(a) Services shall be installed in accordance with applicable requirements of these Safety Orders, and, in addition, shall comply with the following:

(1) Service equipment shall not be installed in a location that is accessible to unqualified persons, unless the equipment is lockable; and

(2) Service equipment shall be mounted on solid backing and installed so as to be protected from the weather, unless the equipment is of weatherproof construction.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.4. Overhead Conductor Clearances.

Amusement rides and amusement attractions shall be maintained not less than 15 feet (4.57 m) in any direction from overhead conductors operating at 600 volts or less, except for the conductors supplying the amusement ride or attraction. Amusement rides or attractions may not be located under or within 15 feet (4.57 m) horizontally of conductors operating in excess of 600 volts.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.5. Wiring Methods.

(a) Flexible cords and cables shall be listed for extra-hard usage. When used outdoors, flexible cords and cables shall also be listed for wet locations and shall be sunlight resistant.

(b) Single conductor cable shall be size No. 2 or larger.

(c) Open conductors are prohibited except as part of a listed assembly or festoon lighting installed in accordance with Article 8, Outdoor Wiring.

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(d) Flexible cords and cables shall be continuous without splice or tap between boxes or fittings. Cord connectors shall not be laid on the ground unless listed for wet locations. Connectors and cable connections shall not be placed in audience traffic paths or within areas accessible to the public unless guarded.

(e) Wiring for an amusement ride, attraction, tent, or similar structure shall not be supported by another ride or structure unless specifically identified for the purpose.

(f) Flexible cords and cables run on the ground, where accessible to the public, shall be covered with approved nonconductive mats. Cables and mats shall be arranged so as not to present a tripping hazard.

(g) A box or fitting shall be installed at each connection point, outlet, switch point, or junction point.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.6. Inside Tents and Concessions.

Electrical wiring for temporary lighting, where installed inside of tents and concessions, shall be securely installed, and, where subject to physical damage, shall be provided with mechanical protection. All temporary lamps for general illumination shall be protected from accidental breakage by a suitable fixture or lampholder with a guard.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.7. Portable Distribution and Termination Boxes.

Employers shall only use portable distribution and termination boxes that meet the following requirements:

(a) Boxes shall be designed so that no live parts are exposed to accidental contact. Where installed outdoors, the box shall be of weatherproof construction and mounted so that the bottom of the enclosure is not less than 6 in. (152 mm) above the ground;

(b) Busbars shall have an ampere rating not less than the overcurrent device supplying the feeder supplying the box. Busbar connectors shall be provided where conductors terminate directly on busbars;

(c) Receptacles shall have overcurrent protection installed within the box. The overcurrent protection shall not exceed the ampere rating of the receptacle, except as permitted in Article 56 for motor loads;

(d) Where single-pole connectors are used, they shall comply with the following:

(1) Where ac single-pole portable cable connectors are used, they shall be listed and of the locking type. Where paralleled sets of current-carrying single-pole separable connectors are provided as input devices, they shall be prominently labeled with a warning indicating the presence of internal parallel connections. The use of single-pole separable connectors shall comply with at least one of the following conditions:

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(A) Connection and disconnection of connectors are only possible where the supply connectors are interlocked to the source and it is not possible to connect or disconnect connectors when the supply is energized; or

(B) Line connectors are of the listed sequential-interlocking type so that load connectors are connected in the following sequence:

1. Equipment grounding conductor connection;

2. Grounded circuit-conductor connection, if provided; and

3. Ungrounded conductor connection; and so that disconnection is in the reverse order; or

(C) A caution notice is provided adjacent to the line connectors indicating that plug connection must be in the following sequence:

1. Equipment grounding conductor connection;

2. Grounded circuit-conductor connection, if provided; and

3. Ungrounded conductor connection; and indicating that disconnection is in the reverse order; and

(2) Single-pole separable connectors used in portable professional motion picture and television equipment may be interchangeable for ac or dc use or for different current ratings on the same premises only if they are listed for ac/dc use and marked to identify the system to which they are connected;

(e) Overcurrent protection of equipment and conductors shall be provided; and

(f) The following equipment connected to the same source shall be bonded:

(1) Metal raceways and metal sheathed cable;

(2) Metal enclosures of electrical equipment; and

(3) Metal frames and metal parts of rides, concessions, trailers, trucks, or other equipment that contain or support electrical equipment.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2584.8. Disconnecting Means.

(a) Each ride and concession shall be provided with a fused disconnect switch or circuit breaker located within sight and within 6 feet (1.83 m) of the operator's station.

(b) The disconnecting means shall be readily accessible to the operator, including when the ride is in operation.

(c) Where accessible to unqualified persons, the enclosure for the switch or circuit breaker shall be of the lockable type.

(d) A shunt trip device that opens the fused disconnect or circuit breaker when a switch located in the ride operator's console is closed is a permissible method of opening the circuit.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 85. Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits

§2585.1. Classification. Class 1, Class 2, and Class 3 remote control, signaling, or power-limited circuits are characterized by their usage and electrical power limitation that differentiates them from light and power circuits. These circuits are classified in accordance with their respective voltage and power limitations as summarized in subsections (a)-(c) below:

(a) A Class 1 power-limited circuit shall be supplied from a source having a rated output of not more than 30 volts and 1000 volt-amperes.

(b) A Class 1 remote control circuit or a Class 1 signaling circuit shall have a voltage not exceeding 600 volts; however, the power output of the source need not be limited.

(c) The power source for a Class 2 or Class 3 circuit shall be listed equipment marked as a Class 2 or Class 3 power source, except as follows:

(1) Thermocouples do not require listing as a Class 2 power source.

(2) A dry cell battery is considered an inherently limited Class 2 power source, provided the voltage is 30 volts or less and the capacity is less than or equal to that available from series-connected No. 6 carbon zinc cells.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2585.2. Marking. A Class 2 or Class 3 power supply unit shall be durably marked where plainly visible to indicate the class of supply and its electrical rating.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2585.3. Separation from Conductors of Other Circuits. For installations built on or after [effective date of these orders] cables and conductors of Class 2 and Class 3 circuits may not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, nonpower-limited fire alarm circuits, and medium power network-powered broadband communications cables unless a barrier or other equivalent form of protection against contact is employed.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 86. Fire Alarm Systems

§2586.1. Classifications. Fire alarm circuits shall be classified either as nonpower limited or power limited.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2586.2. Power Sources. The power sources for use with fire alarm circuits shall be either power limited or nonpower limited as follows:

(a) The power source of nonpower-limited fire alarm (NPLFA) circuits shall have an output voltage of not more than 600 volts, nominal; and

(b) The power source for a power-limited fire alarm (PLFA) circuit shall be listed equipment marked as a PLFA power source.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2586.3. Separation from Conductors of Other Circuits.

(a) Nonpower-limited fire alarm circuits and Class 1 circuits may occupy the same enclosure, cable, or raceway provided all conductors are insulated for maximum voltage of any conductor within the enclosure, cable, or raceway. Power supply and fire alarm circuit conductors are permitted in the same enclosure, cable, or raceway only if connected to the same equipment.

(b) Power-limited circuit cables and conductors may not be placed in any cable, cable tray, compartment, enclosure, outlet box, raceway, or similar fitting with conductors of electric light, power, Class 1, non-power-limited fire alarm circuit conductors, or medium power network-powered broadband communications circuits.

(c) Power-limited fire alarm circuit conductors shall be separated at least 2 in. (50.8 mm) from conductors of any electric light, power, Class 1, nonpower-limited fire alarm, or medium power network-powered broadband communications circuits unless a special and equally protective method of conductor separation is employed.

(d) Conductors of one or more Class 2 circuits are permitted within the same cable, enclosure, or raceway with conductors of power-limited fire alarm circuits provided that the insulation of Class 2 circuit conductors in the cable, enclosure, or raceway is at least that needed for the power-limited fire alarm circuits.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2586.4. Identification. Fire alarm circuits shall be identified at terminal and junction locations in a manner that will prevent unintentional interference with the signaling circuit during testing

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and servicing. Power-limited fire alarm circuits shall be durably marked as such where plainly visible at terminations.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 87. Communications Systems

§2587.1. Scope.

This Article applies to central-station-connected and non-central-station-connected telephone circuits, radio and television receiving and transmitting equipment, including community antenna television and radio distribution systems, telegraph, district messenger, and outside wiring for fire and burglar alarm, and similar central station systems. These installations need not comply with the provisions of Article 2 through Article 86 of these Low-Voltage Electrical Safety Orders, except for Section 2375.7 and Article 59.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2587.2. Protective Devices.

(a) A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block.

(b) A listed primary protector shall be also provided on each aerial or underground circuit when the location of the circuit within the block containing the building served allows the circuit to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground.

(c) In addition, where there exists a lightning exposure, each interbuilding circuit on premises shall be protected by a listed primary protector at each end of the interbuilding circuit.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2587.3. Conductor Location.

(a) Lead-in or aerial-drop cables from a pole or other support, including the point of initial attachment to a building or structure, shall be kept away from electric light, power, Class 1, or nonpower-limited fire alarm circuit conductors so as to avoid the possibility of accidental contact.

(b) A separation of at least 6 feet (1.83 m) shall be maintained between communications wires and cables on buildings and lightning conductors.

(c) Where communications wires and cables and electric light or power conductors are supported by the same pole or run parallel to each other in-span, the following conditions shall be met:

(1) Where practicable, communication wires and cables on poles shall be located below the electric light or power conductors; and

(2) Communications wires and cables shall not be attached to a crossarm that carries electric light or power conductors.



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(d) Indoor communications wires and cables shall be separated at least 2 in. (50.8 mm.) from conductors of any electric light, power, Class 1, non-power-limited fire alarm, or medium power network-powered broadband communications circuits, unless a special and equally protective method of conductor separation, identified for the purpose, is employed.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2587.4. Equipment Location. Outdoor metal structures supporting antennas, as well as self-supporting antennas such as vertical rods or dipole structures, shall be located as far away from overhead conductors of electric light and power circuits of over 150 volts to ground as necessary to prevent the antenna or structure from falling into or making accidental contact with such circuits.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2587.5. Grounding.

(a) If exposed to contact with electric light and power conductors, the metal sheath of aerial cables entering buildings shall be grounded or shall be interrupted close to the entrance to the building by an insulating joint or equivalent device. Where protective devices are used, they shall be grounded in an approved manner.

(b) Masts and metal structures supporting antennas shall be permanently and effectively grounded without splice or connection in the grounding conductor.

(c) Transmitters shall be enclosed in a metal frame or grill or separated from the operating space by a barrier, all metallic parts of which are effectively connected to ground. All external metal handles and controls accessible to the operating personnel shall be effectively grounded.

Unpowered equipment and enclosures are considered to be grounded where connected to an attached coaxial cable with an effectively grounded metallic shield.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 88. Solar Photovoltaic Systems

§2588.1. Scope. This Article covers solar photovoltaic systems constructed or installed on or after [effective date of these orders] that can be interactive with other electric power production sources or can stand alone with or without electrical energy storage such as batteries. These systems may have ac or dc output for utilization.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2588.2. Conductors of Different Systems. Photovoltaic source circuits and photovoltaic output circuits shall not be contained in the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as feeders or branch circuits of other systems, unless the conductors of the different systems are separated by a partition or are connected together.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2588.3. Disconnecting Means. Means shall be provided to disconnect all current-carrying conductors of a photovoltaic power source from all other conductors in a building or other structure. Where a circuit grounding connection is not designed to be automatically interrupted as part of the ground-fault protection system, a switch or circuit breaker used as disconnecting means shall not have a pole in the grounded conductor.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 89. Integrated Electrical Systems

§2589.1. Scope.

This Article covers integrated electrical systems, other than unit equipment, in which orderly shutdown is necessary to ensure safe operation. An integrated electrical system as used in this section shall be a unitized segment of an industrial wiring system where all of the following conditions are met:

- (a) An orderly shutdown process minimizes employee hazard and equipment damage;
- (b) The conditions of maintenance and supervision ensure that only qualified persons will service the system; and
- (c) Effective safeguards are established and maintained.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§2589.2. Location of Overcurrent Devices in or on Premises.

Overcurrent devices that are critical to integrated electrical systems need not be readily accessible to employees as required by Section 2390.24 if they are located with mounting heights to ensure security from operation by unqualified persons.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.